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COTTON EXPERIMENTS, 1927

SOUTH MISSISSIPPI EXPERIMENT STATION

By
E. B. FERRIS

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COTTON EXPERIMENTS, 1927

With few exceptions the work done here in 1927 with cotton has been the same as that done in 1925 and 1926. This work, especially that with fertilizers, should be more valuable by reason of the fact that it was the second and third time the experiments were conducted on the same plots.

The seasons here in 1927 were very unfavorable for cotton and all yields reported in this bulletin are quite low as a result. While the total rainfall from March to November inclusive was not unusually high, it came in such a way and at such times as to cause this cotton to shed badly long before the boll weevil did any damage of consequence. Comparing the total rainfall with previous years, our records show that during the months above given the rainfall here was 31.08 inches in 1925, 46.95 in 1926 and 40.31 in 1927, though this is being written four days before the close of the month.

The only material addition to our regular work with cotton this year has been the starting of cooperative work with Dr. D. C. Neal, Plant Pathologist of the Central Station at the A. & M. College, testing the effects of a number of potash carriers used in varying amounts on the control of rust and wilt in cotton.

From 1919 through 1924, 56 plots of land here had been used for fertilizer experiments with cotton, but for several seasons these plots had been taken from cotton and in 1925 and 1926 had been planted to corn, this having been fertilized uniformly the first year with nitrate of soda alone and the second year with a mixture of nitrate of soda and acid phosphate, no potash having been used on any of the plots. The idea in so doing was to plant cotton again on these plots and fertilize it in the same ways it had been through 1924 to see if the change to corn would influence the rust and wilt, both of which had become quite bad, especially rust where no potash had been used.

This was the only land available in 1927 when it was decided to cooperate with Dr. Neal in the above mentioned work, and the previous treatments lent themselves well to work of this character for many of the plots had received no potash since 1918, if they had ever received any. In planning this work, plots which during this time had received no potash were used as checks in Dr. Neal's work, for experiments had shown that until the natural supply of potash had been exhausted by several years cropping the addition of this element had not given increased yields. The result was that from the beginning of the season plots without potash showed up the need of this material decidedly and by the middle of the growing season could easily be told at a glance.

Fifty-six one-twelfth acre plots were used in this test and the various treatments were replicated four times each on inoculated and uninoculated land. While wilt had been present over a large part of the plots inoculated even in 1924, this half of the field was thoroughly inoculated with wilt cultures made by Dr. Neal, previous to the application of the fertilizer or the planting of the cotton.

The basis of the fertilizer used uniformly over the field, except on four

unfertilized plots, was 600 pounds per acre of an 8-4-0 fertilizer, to which was added potash from various sources, running from 4 per cent up to 12 per cent. When the percentage of potash was varied, muriate was used as its source and when the source of potash was under test a fertilizer containing 8 per cent was always used. Unfortunately, we were not able to use check plots at the beginning and end of each series nor so often between as we should have liked, due to the arrangement of these plots years before.

Table No. 1 gives the results of this work in averages for the inoculated and uninoculated plots as well as the percentage of stalks affected with wilt in each.

Fig. 1—Receiving P2O5-N, but no K2O.

Fig. 2—Receiving Phos.-N and K2O.

Table No. 1—Effect of Potash Fertilizers on Wilt

Treatment per acre			Increase lbs. seed cotton per A 600 8-6-0 as zero		
Pounds	Analysis	Source of Potash	No inoculation	Wilt inoculation	Percent wilt
No fertilizer			-323	-271	24.3
600	8-6-0				23.6
600	8-6-8	KCL	448	322	16.0
600	8-6-8	K2SO4	290	243	6.0
600	8-6-8	D. manure salt	367	249	20.0
600	8-6-8	Kainit	424	340	5.0
600	8-6-4	KCL	437	339	5.4
600	8-6-10	KCL	403	256	7.7
600	8-6-12	KCL	288	258	16.3

Regular Fertilizer Work

The same fertilizer work started here and elsewhere in the state in 1925 by all the stations, except the one in the Delta, was continued here this year on the same plots, this being on leased land selected because of its uniformity. This being the third year of the experiment, wilt is beginning to show up badly on some of the plots and this, with poor seasons for cotton, caused the yields this year to be very unsatisfactory, but differences in yield, due to fertilizers, still show up markedly.

Weevils were especially bad toward the end of the season but did not reduce yields anything like as much as did the seasons. All this cotton was poisoned three times, as was all the cotton on this station, and weevils got

Table No. 2—Analysis Test, Moody Field, 1927

Pounds of material applied per acre			Analysis	Pounds of seed cotton per acre			Dollars per acre		
Acid Phos.	Nit. of soda	Mur. of potash		Plot yield	Check yield	Increase	Value of increase	Cost of fert.	Net gain
No fertilizer				513					
300	160	100	8-4-8	1020	466.75	553.25	38.73	9.33	29.40
300	160	75	8-4-6	1003	420.50	572.50	40.07	8.73	31.34
300	160	50	8-4-4	977	374.25	602.75	42.19	8.13	34.06
No fertilizer				328					
300	160	25	8-4-2	1053	302.75	750.25	52.52	7.53	44.99
300	160		8-4-0	845	277.50	567.50	39.72	6.93	32.79
300	320	50	8-8-4	917	252.25	664.75	46.53	12.81	33.72
No fertilizer				227					
300	240	50	8-6-4	954	223.50	730.50	51.13	10.47	40.66
225	160	50	6-4-4	807	220.00	587.00	41.09	7.57	33.52
150	160	50	4-4-4	653	216.50	436.50	30.55	7.00	23.55
No fertilizer				213					
600	320	100	8-4-4	936	279.25	656.75	45.97	16.26	29.71
900	480	150	8-4-4	1002	345.50	656.50	45.95	24.39	21.56
1200	640	200	8-4-4	1065	411.75	653.25	45.73	32.52	13.21
No fertilizer				478					

NOTE—In all tables reporting analysis tests the three fertilized plots received 1200, 1800, and 2400 pounds respectively, of an 8-4-4 fertilizer. All other treatments received at the rate of 600 pounds per acre of the indicated analysis.

beyond control long after the cotton had had time to put on a maximum crop if the seasons earlier had been favorable to its fruiting. In all experiments at Hattiesburg perfect stands were obtained. In the main, good stands were maintained throughout the year except on the checks, or unfertilized plots, where some of the cotton was killed by cool weather when it was quite young and where wilt was especially bad. Practically all this cotton was planted between the first and tenth of April, all cotton in the same test being planted the same day.

Table No. 2 gives the results in this analysis test in detail, the results reported being the average of triplicate tests.

Test with Potash Sources

In the same field described above, work was done for the third year on the same plots, testing five sources of potash under cotton. In this work all plots were fertilized uniformly with an 8-4-0 fertilizer at the rate of 600 pounds per acre and 24 pounds per acre of actual potash applied from the several sources of each of three plots receiving it. This was done in the same way described above and the variety of cotton, Lone Star 65, planted the same day. While the differences due to the presence or absence of potash under this cotton were never so outstanding as in the cooperative work with Dr. Neal, the final weights all showed material increases as a result of this potash. This was the first time the use of potash had materially affected yields in this particular work.

Table No. 3 gives this work in detail, each result reported being the average of triplicate tests.

Table No. 3—Potash Sources, Moody Field, 1927.

Pound per acre	Analysis	Sources of Potash	Pounds of seed cotton per acre		
			Plot Yield	Check Yield	Increase
600	8-4-0		692		
600	8-4-4	Sul. pot.	748	674.00	74.00
600	8-4-4	Pot. chlo.	863	656.00	207.00
600	8-4-4	Kainit	807	638.00	169.00
600	8-4-0		630		
600	8-4-4	D. Man. salt	732	648.33	83.67
600	8-4-4	Kemfert	751	676.67	74.33
600	8-4-0		705		

Tests with Six Nitrogen Sources

In the same field with the analysis and potash sources tests above given, experiments were conducted for the third time on the same plots, testing six sources of nitrogen. In this work all plots were fertilized uniformly with 600 pounds per acre of an 8-0-4 fertilizer and 24 pounds of actual nitrogen applied from the several sources to each of the three plots receiving it. These fertilizers were applied the same day and the same way as described under the analysis tests and Lone Star 65 cotton seed planted a few days later. The cotton was treated the same way as to cultivation, poisoning, etc., as that above mentioned and suffered alike as a result of poor seasons.

Table No. 4 gives these results in detail.

Table No. 4—Nitrogen Sources, Moody Field, 1927

Pounds per acre	Analysis	Sources of Nitrogen	Pounds of seed cotton per acre		
			Plot Yield	Check Yield	Increase
600	8-0-4		592		
600	8-4-4	Nit. soda	877	615.25	261.75
600	8-4-4	Ammon. sul.	848	638.50	209.50
600	8-4-4	Cal. cyanam.	990	661.75	328.25
600	8-0-4		685		
600	8-4-4	G. Cal. nit.	964	663.00	301.00
600	8-4-4	Urea	967	641.00	326.00
600	8-4-4	Leunasalpeter	969	619.00	350.00
600	8-0-4		597		

Additional Nitrogen Sources Tests

The regular nitrogen sources tests given in Table No. 4 were started in 1925 and later when it was decided to test other sources there was no available land near by and such additional work had to be started in another field in 1926 where it has been done since. This work was in three replications, all plots receiving the equivalent of 600 pounds per acre of an 8-0-4 fertilizer with the nitrogen plots receiving 24 pounds of actual nitrogen per acre. This work was done on land used as pasture up to 1926 and was not so uniform in composition as that on which the regular nitrogen sources tests were conducted.

Table No. 5 gives the results obtained in detail, each being the average of three plots devoted to the same treatment.

Table No. 5—Additional Nitrogen Sources, 1927.

Pounds per acre	Analysis	Sources of Nitrogen	Pounds of seed cotton per cwt.		
			Plot Yield	Check Yield	Increase
600	8-0-4		937.5		
600	8-4-4	Nitropo	1117.5	900.00	217.50
600	8-4-4	Fish scrap	1027.5	862.50	165.00
600	8-4-4	Tankage	952.5	825.00	127.50
600	8-0-4		787.5		
600	8-0-4		1035.0		
600	8-4-4	½ fish scrap			
		½ NaNo3	1245.0	1021.88	223.12
600	8-4-4	½ Tankage			
		½ NaNo3	1185.0	1008.75	176.25
600	8-4-4	Cal. nitrate	1207.5	995.63	211.87
600	8-0-4		982.5		

Tests with Nitrogen Sources at Purvis

In 1926 tests with five nitrogen sources were started at Purvis in Lamar County in cooperation with County Agent W. M. Morris on the farm of E. I. Saye, located about two miles north of Purvis, immediately beside Highway 11. Suitable land was available for only five such tests and

since Mr. Morris was already using nitrate of soda and calcium cyanamid in other tests on the same farm, our work eliminated these and used the ones mentioned in Table No. 6, which gives the results obtained in duplicate tests. The same method of applying these fertilizers was used in this experiment as in the ones on the station proper, but no poisoning was done for the control of the boll weevil.

Table No. 6—Nitrogen Sources, E. F. Saye, Purvis, Miss, 1927

Pounds per acre	Analysis	Sources of Nitrogen	Pounds of seed cotton per acre		
			Plot Yield	Check Yield	Increase
600	8-0-4		960		
600	8-4-4	Ammon. sul.	1095	963.75	131.25
600	8-4-4	Leunasalpeter	1080	967.50	112.50
600	8-4-4	Cal. nit.	1110	971.25	138.75
600	8-0-4		975		
600	8-4-4	Urea	1065	945.00	120.00
600	8-4-4	Tankage	1035	915.00	120.00
600	8-0-4		885		

Factory Mixed vs. Home Mixed Fertilizers Under Cotton

This work was done in the same field mentioned in the preceding paragraph in regard to additional nitrogen sources tests, and the same plots fertilized in the same way as in 1926 were used again in 1927. The home mixtures used were made by mixing acid phosphate, nitrate of soda and muriate of potash in the proper proportions to furnish the same plant food as would be supplied by the factory mixed fertilizers. In carrying out the experiment small quantities of 8-5-4 and 10-5-3 fertilizers were ordered from the factories, but the 8-4-4 fertilizer used was taken from a large shipment ordered and used here for general work.

The same thing may be said about the effects of the weather on these yields as has been said elsewhere in this circular. This cotton was poisoned three times against the weevil and while these got to be quite bad toward the latter part of the season, the low yields were due more to adverse weather conditions than to the weevil. The fertilizers used in this test were applied by hand on top of lists that had been made some time before, mixed with the soil and beds completed. The applications were weighed for each

Table No. 7—Factory vs. Home Mixed Fertilizer, 1927

Lbs. material applied per A		Analysis	Pounds of seed cotton per acre		
Factory mixed	Home mixed		Plot Yield	Check Yield	Increase
No fertilizer			547		
600		8-4-4	1100	584.00	516.00
	600	8-4-4	1070	621.00	449.00
600		8-5-4	1035	658.00	377.00
No fertilizer			695		
	600	8-5-4	1040	696.75	343.25
600		10-5-3	1075	698.50	376.50
	600	10-5-3	1015	700.25	314.75
No fertilizer			702		

row and put out March 29 and Lone Star 65 cotton seed planted April 4. Perfect stands were obtained.

Table No. 7 gives the results of this work in detail, the figures given being the average of triplicate tests in each instance.

Old Fertilizer Tests with Cotton

There are twelve plots in this test with no duplications and these have received the same quantities of nitrogen, phosphorus and potash, when fertilized, since 1919. These plots were planted two years to sweet potatoes, one year to corn, and 1927 was the sixth successive year they have been planted to cotton. In the beginning of the use of cotton on these plots the presence or absence of potash in a fertilizer made little or no difference in the appearance or final yield of the crop, but in recent years the plot without potash has gone badly to pieces, wilt and rust together having brought the yields practically down to the unfertilized plot beside it. This unfertilized plot has also been much less affected by rust or wilt than the one well fertilized, except for potash. This would indicate that when given liberal amounts of phosphorus and nitrogen during all these years, the supply of potash in the soil had been exhausted earlier than where no fertilizer had been used.

From the beginning the absence of phosphorus or nitrogen in the fertilizers used has been quite apparent both in appearance and yield. It was the work on this particular acre that drew the attention of scientists and fertilizer men to this station, resulting in the holding here of several schools last year and this, when scientists, fertilizer manufacturers and fertilizer salesmen came here in large numbers to study these and other experiments with fertilizers in progress here. This particular work also led this year to the inauguration of the further work with potash done with Dr. Neal and described elsewhere in this circular, as well as to the future work contemplated, the expense of which will be borne by the potash importers.

This particular work has also attracted much attention from visiting farmers and students who learn from it the importance of using balanced fertilizers in any permanent system of agriculture on similar types of soil. The diagram following shows the arrangement of these plots, the way they have been fertilized for the past nine years and the 1927 yields of

DIAGRAM

Old Fertilizer Test
(Amounts applied and yields per acre)

400 A. P. 100 P. C.	414	200 A. P. 200 N. S. 100 P. C.	837	400 A. P. 200 N. S. 100 P. C.	981	400 A. P. 200 N. S.	324
Check	54	Check	147	Check	351	Check	216
400 A. P. 400 N. S. 250 P. C.	1080	200 N. S. 100 P. C.	463	400 A. P. 200 N. S. 150 P. C.	1089	400 A. P. 200 N. S. 50 P. C.	900

seed cotton from the several treatments. In interpreting the results it should be realized that the natural fertility of the field varies widely, due to its topography, making necessary the use of many checks. In this table acid phosphate is designated as A. P., nitrate of soda as N. S. and potassium chloride or muriate of potash as P. C. In order to show difference in yield due to the several fertilizer combinations, it is necessary to subtract the check yield from the adjoining fertilized plots, since such check yields vary so greatly. The diagram is self explanatory.

Varieties of Cotton

Tests with 23 varieties of cotton were carried out here in 1927 on the same land used in 1926 and fertilized uniformly with an 8-4-4 fertilizer applied at the rate of 600 pounds per acre. These varieties were planted in single rows, each variety being repeated eight times in most instances and average yields are reported below. Samples of each were taken and sent to the A. & M. College for ginning and determination of lint percentage, length of staple and value per pound of the resulting samples.

Table No. 8 gives the results of this work in detail.

Table No. 8—Cotton Varieties, Poplarville, 1927.

Variety	Pounds per acre		Lint data			Total dollars per acre	Rank in value
	Seed cotton	Lint	Percentage	Length	Cents per lb.		
Trice	1225	400.6	32.7	1	20.71	96.97	5
Cleveland, Wan.	1026	374.5	36.5	7/8	19.25	83.17	15
Cleveland 5	1104	388.6	35.2	1	20.71	92.64	8
Cleveland 54	1084	375.1	34.6	7/8f	19.59	85.53	12
Cleveland, Wilson	1086	357.3	32.9	7/8f	19.59	82.39	16
Cleveland, Pied.	1044	339.3	32.5	7/8	19.25	77.30	20
Half & Half	994	392.6	39.5	13/16	18.38	82.38	17
Cook 1010	951	372.8	39.2	13/16	18.38	78.35	19
Willis	1021	332.8	32.6	7/8f	19.59	76.90	22
Acala	1019	358.7	35.2	15/16f	20.31	84.08	13
Miller	951	318.6	33.5	1	20.71	76,73	23
D. & P. L. 4	931	323.1	34.7	1	20.71	77.24	21
D. & P. L. 8	952	347.5	36.5	15/16f	20.31	80.86	18
Deltatype	997	311.1	31.2	1 3/16	24.81	88.84	10
Delfos 910	1092	346.2	31.7	1 1/8f	23.81	95.11	6
Delfos 1374	1090	340.1	31.2	1 1/8f	23.81	93.73	7
Delfos 911	1292	423.8	32.8	1 1/16f	22.03	108.12	1
Delfos 1341	1254	426.4	34.0	1 1/16f	22.03	108.01	2
Delfos 6102	1194	386.9	32.4	1 1/16f	22.03	98.95	4
D. & P. L. 6	1100	403.7	36.7	1 1/8	23.31	105.94	3
Light. Express	1066	344.3	32.3	1 1/8	23.31	92.53	9
Lone Star 168	985	334.9	34.0	1 1/16	21.71	83.76	14
Lone Star 65	1025	349.5	34.1	1 1/16	21.71	87.36	11

After planting the quantity required of the seed tested here, sixteen of these varieties were tested in a cooperative experiment with County Agent A. J. Flowers of Pike County on the farm of Mr. G. H. Alford near Progress Consolidated School, where cooperative work with fertilizers under cotton was also done. It might be well to mention here that Mr. Flowers and Mr. Alford hold annually at this consolidated school farmers meetings lasting

three days, to which farmers and business men from Pike and adjoining counties come to hear discussions on all phases of farm work, and on the days devoted to farm crops a representative of this station has always been present to discuss such problems as are most timely, using the e tests as demonstrations of the proper use of fertilizers and varieties.

Table No. 9 gives the yields of cotton obtained this year in these tests.

Table No. 9—Cotton Varieties, Pike County, 1927.

Variety	Pounds per acre		Lint data			Total dollars per acre	Rank in value
	Seed cotton	Lint	Percentage	Length	Cents per lb.		
Trice	1440	470.9	32.7	1	20.71	113.99	6
Cleveland, Wan.	1030	376.0	36.5	7/8	19.25	83.50	13
Cleveland, Pied.	1380	448.5	32.5	7/8	19.25	102.18	9
Half & Half	1290	509.6	39.5	13/16	18.38	106.93	8
Cook 1010	1230	482.2	39.2	13/16	18.38	101.34	10
Willis	1250	407.5	32.6	7/8f	19.59	94.15	12
Acala	1410	496.3	35.2	15/16f	20.31	116.33	4
Miller	920	308.2	33.5	1	20.71	74.23	14
D. & P. L. 4	1190	412.9	34.7	1	20.71	98.72	11
Delfos 911	1730	567.4	32.8	1 1/16f	22.03	144.76	1
Delfos 6102	1300	421.2	32.4	1 1/16f	22.03	107.73	7
D. & P. L. 6	1460	535.8	36.7	1 1/8	23.31	140.60	2
Light. Express	1540	497.4	32.3	1 1/8	23.31	133.66	3
Lone Star 65	1350	460.4	34.1	1 1/16	21.71	115.07	5

Rotation Experiment

In our regular annual report we discuss the use here of 84 plots of land fertilized the same way and used since 1919 in testing different cropping systems. On 21 plots, replicated four times, we are using 12 cropping systems in which cotton is used in seven rotations. On one plot of each series, cotton has been planted continuously and for the past two years the cotton on such plots has gone largely to pieces as a result of wilt. This year on the sandier parts of this field the land used continuously for cotton has made less than 100 pounds of seed cotton per acre, whereas on adjoining plots where it has been grown in rotation with other crops the yields have been above 700 pounds, showing the danger of continuously planting of cotton on the same land from the standpoint of disease alone.

High Analysis vs. Low Analysis Fertilizers

In 1927 we conducted on 21 plots of land experiments in triplicate to compare high and low analysis fertilizers, using acid phosphate, nitrate of soda and muriate of potash in making the low analysis fertilizer to be thus compared. Six hundred pounds per acre of the home mixed 8-4-4 fertilizer was used as a check and this furnished the same amount of phosphorus, nitrogen and potash as was contained in 150 pounds of the new German fertilizer, nitrophoska, analyzing 32-16-16. Three hundred pounds of a 15-5-5 factory mixed fertilizer was compared with 600 pounds of a 7½-2½-2½, home mixed. Three hundred pounds of 20-16½-0, or ammophos, was compared with 600 pounds of a home mixture analyzing 10-8¼-0.

The home mixed 8-4-4, being used as a check, was repeated several times throughout the 20 plots, or a total of six times all told. The other fertilizers were each repeated three times, but two plots, one fertilized with 20-16½-0 and the other with 32-16-16 were discarded, due to bad stand.

The average yield of seed cotton from six plots fertilized at the rate of 600 pounds per acre of home mixed 8-4-4 was 1002 pounds; the average yield of two plots fertilized with 150 pounds of 32-16-16 was 900 pounds; the average yield of three plots fertilized with 300 pounds of 15-5-5 was 1044; the average yield of three plots fertilized with 600 of 7½-2½-2½ was 1188; the average yield of two plots fertilized with 300 pounds of 20-16½-0 was 1020; and the average yield of three plots fertilized with 600 pounds of 10-8¼-0 was 1050.

These fertilizers were applied on top of a list and harrowed in on April 2, and Lone Star 65 cotton was planted April 4. In the earlier part of the season the cotton fertilized with the high analysis fertilizers did not grow off as well as when fertilized with those of low analysis and considerably more of the cotton died when very young, but as the season advanced the cotton improved and toward the end little difference could be told so far as the eye was concerned. Possibly some of the difference between the high and low analysis fertilizers might be attributed to this loss of stand. As reported above, we did discard one plot fertilized with 20-16½-0 and another fertilized with 32-16-16 because the yields were entirely too low and out of line, possibly due to bad stands.

Cooperative Fertilizer Tests with Cotton

In 1926 cooperative fertilizer tests were conducted with cotton in four South Mississippi counties, always cooperating with the county agents of such counties and on farms operated by careful men capable of keeping

Table No. 10—Analysis Test, G. H. Alford, Pike County, 1927.

Lbs. material applied per A.			Analysis	Lbs. seed cotton per A.			Dollars per acre		
Acid phos.	Nitrate of soda	Mur. of potash		Plot yield	Check yield	Increase	Value of increase	Cost of fert.	Net gain
No fertilizer				480.00					
300	160	100	8-4-8	886.67	420.00	466.67	32.66	9.33	23.33
300	160	75	8-4-6	920.00	360.00	560.00	39.20	8.73	30.47
300	160	50	8-4-4	946.67	300.00	646.67	45.27	8.13	37.14
No fertilizer				240.00					
300	160	25	8-4-2	906.67	261.67	645.00	45.15	7.53	37.62
300	160		8-4-0	806.67	283.34	523.33	36.63	6.93	29.70
300	320	50	8-8-4	980.00	305.00	675.00	47.25	12.81	34.44
No fertilizer				326.67					
No fertilizer				433.33					
300	240	50	8-6-4	1060.00	415.00	645.00	45.15	10.47	34.68
225	160	50	6-4-4	926.67	396.67	530.00	37.10	7.57	29.53
150	160	50	4-4-4	1000.00	378.33	621.67	43.52	7.00	36.52
No fertilizer				360.00					
No fertilizer				340.00					
600	320	100	8-4-4	1360.00	366.67	993.33	69.53	16.26	53.27
900	480	150	8-4-4	1300.00	393.33	906.67	63.47	24.39	39.08
1200	640	200	8-4-4	1346.67	420.00	926.67	64.87	32.52	32.35
No fertilizer				446.67					

Table No. 11--Analysis Test, E. F. Saye, Purvis, Miss., 1927

Lbs. material applied per A.			Analysis	Lbs. seed cotton per A.			Dollars per acre		
Acid phos.	Nitrate of soda	Mur. of potash		Plot yield	Check yield	Increase	Value of increase	Cost of fert.	Net gain
No fertilizer				960					
300	160	100	8-4-8	1380	922.50	457.50	32.02	9.33	22.69
300	160	75	8-4-6	1275	885.00	390.00	27.30	8.73	18.57
300	160	50	8-4-4	1290	847.50	442.50	30.97	8.13	22.84
No fertilizer				810					
300	160	25	8-4-2	1260	780.00	480.00	33.60	7.53	26.07
300	160		8-4-0	1155	750.00	405.00	28.35	6.93	21.42
300	320	50	8-8-4	1275	720.00	555.00	38.85	12.81	26.04
No fertilizer				690					
300	240	50	8-6-4	1170	708.75	461.25	32.29	10.47	21.82
225	160	50	6-4-4	1230	727.50	502.50	35.17	7.57	27.60
150	160	50	4-4-4	1185	746.25	438.75	30.71	7.00	23.71
No fertilizer				765					
600	320	100	8-4-4	1425	780.00	645.00	45.15	16.26	28.89
900	480	150	8-4-4	1425	795.00	630.00	44.10	24.39	19.71
1200	640	200	8-4-4	1455	810.00	645.00	45.15	32.52	12.63
No fertilizer				825					

accurate records with such assistance as can be given by us and the agents themselves. The cooperator in Harrison County did not care to continue the work this year, but it was continued in each of the other three counties.

In all of these tests the same fertilizer formulas are used, being the ones worked out nearly three years ago at a conference at the A. & M. College where the best thought of all the experiment station workers of the state, with the assistance of the leading fertilizer men of the country, was brought into play. These same tests are being carried out at all the hill stations of the state on the stations proper and in all their cooperative work and can therefore be easily compared.

We have already mentioned other cooperative work in Pike and Lamar Counties and it will suffice here to say that in Pike County these fertilizer tests were conducted in three replications, while that in Lamar county was done with only two replications, due to lack of suitable land. Tables No. 10 and No. 11 give in detail the results of these tests. In each of these tests the same plots were used for the second time.

For the third year in succession this work was done in Forrest County, cooperating with County Agent W. M. Sellers and on the farm of Mr. T. E. McCardle. This work was done in four replications and Table No. 12 gives it in detail. On account of poor stands in certain parts of Mr. McCardle's field, apparently due to a stoppage of the planter in this part of the field, we were forced to make corrections in certain plots which we did together by counting the stalks on these and adjacent plots and estimating differences due to stands. With these few exceptions the yields reported below are just as they were weighed in the field after calculating them on the acre basis.

Table No. 12—Analysis Test, J. E. McCardle, Forrest County, 1927.

Lbs. material applied per A.			Analysis	Lbs. seed cotton per A.			Dollars per acre		
Acid phos.	Nitrate of soda	Mur. of potash		Plot yield	Check yield	increase	Value of increase	Cost of fert.	Net gain
No fertilizer				900					
300	160	100	8-4-8	1433	894	539	37.73	9.33	28.40
300	160	75	8-4-6	1408	888	520	36.40	8.75	27.67
300	160	50	8-4-4	1458	882	576	40.32	8.13	32.19
No fertilizer				875					
300	160	25	8-4-2	1516	867	649	45.43	7.53	37.90
300	160		8-4-0	1358	858	500	35.00	6.93	28.07
300	320	50	8-8-4	1583	850	733	51.31	12.81	38.50
No fertilizer				842					
300	240	50	8-6-4	1492	865	627	43.89	10.47	33.42
225	160	50	6-4-4	1433	888	545	38.15	7.57	30.58
150	160	50	4-4-4	1417	911	506	35.42	7.00	28.42
No fertilizer				933					
No fertilizer				941					
600	320	100	8-4-4	2075	954	1121	78.47	16.25	62.21
900	480	150	8-4-4	2033	966	1067	74.69	24.39	50.30
1200	640	200	8-4-4	2075	979	1096	76.72	32.52	44.20
No fertilizer				992					

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REPORT
RAYMOND BRANCH EXPERIMENT STATION, 1927

By

H. F. Wallace

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi.
J. R. Ricks, Director

Report of Work at The Raymond Branch Experiment Station, 1927

By H. F. Wallace

Introduction

This report contains a summary of the work conducted on the Raymond Branch Experiment Station for the year of 1927. Many tables included herein will give averages for a period of years, whereby results with various fertilizers and varieties will be more accurate. Other publications from this station may be secured upon request from the Mississippi Experiment Station, A. and M. College, Mississippi.

Experiments were expressly conducted to determine the kinds and quantities of fertilizers, varieties and cultural methods of cotton, corn, legumes and truck crops best suited for the southern section of the Brown Loam soil area of Mississippi. Various inoculating materials for legumes have been tested and found to give about equal results. Lime has been applied to non-lime soils and good cuttings of alfalfa have resulted when planted to this crop.

As a crop year, 1927 was good and good yields resulted from early and late crops. The growing period was long and fertilizers composed of slow acting materials gave excellent results as compared with some past years. Late maturing varieties gave good yields and ninteen varieties of corn planted July 8 all matured hard corn for the crib.

The planting season was ushered in by quite a bit of rain and temperatures were a little lower than usual, very probably due to such a vast area of the nearby delta section being under water. On April 23 a heavy frost materially injured cotton and corn that had been chopped. These crops thus affected were held at a standstill for at least two weeks or more. Serious damage resulted to corn by the appearance of the commonly called sugar cane beetle. One field of five acres on the station was damaged eighty per cent. A later planting resulted in a good stand and due to a late dry fall produced good yields. The boll weevil caused quite a bit of damage in early August, as daily showers for a period of three weeks would wash the poison off before it became effective. There is no doubt but that the 1927 yield of 192 pounds of lint cotton per acre on the average for Mississippi was caused to some extent by the boll weevil. Although 275 pounds of lint per acre was produced in 1925, the best cotton year we have experienced, the farm value of the 1927 crop was only twenty-five per cent less.

For this station, the year of 1927 was a very satisfactory crop season. Truck crops gave excellent yields, hay crops were all good, corn and soybeans were harvested in fine shape and cotton produced more than a bale per acre on the average. Many visitors came to the station and were impressed with the work being done . Much credit is due our capable farm manager, Mr. J. C. Peyton, and also to Mr. J. L. Cooley, Jr., graduate student employed by the Educational Bureau of

the Chilean Nitrate Company, who rendered material assistance with the horticultural experiments.

Cotton

The average yield of cotton per acre in Mississippi during 1927 was four pounds higher than the five year average which included the bumper crop of 1925. There seems no doubt but that Mississippi farmers are using more intelligent farming methods than in the past and this increase in yield is very probably due to soil improvement, judicious use of fertilizer, improved varieties and close spacing. Many are building up their soil by using legumes in rotations. A wise policy is to make more cotton on fewer acres and raise enough food for the home and feed for the stock. To aid increased production of cotton per acre, the following tables will reveal actual yields produced on our fields this past year.

Below may be seen the results with twenty-four leading varieties of cotton which were planted on both valley and hill land, as shown in Table 1 for the valley and Table 2 for the hill test.

TABLE 1—COTTON VARIETY TEST—VALLEY LAND—1927

Variety	Pounds per acre		Lint data			Rank in value	
	Seed cotton	Lint	Percentage	Length	Cents per lb.	Total value per acre	1927	Seven years average 1921-1927
Trice, Miss. Sta.	1608	532.2	33.1	1 1/16	21.71	137.06	8	5
Cleve., Wann.	1270	480.1	37.8	7/8 f	19.59	109.85	20	10
Cleve. 5	1277	440.6	34.5	1 1/16 f	22.03	113.79	18	
Cleve. 54	1492	541.6	36.3	1 1/16 f	20.31	129.01	14	4
Cleve., Wilson	1310	459.8	35.1	1 1/16	20.09	109.38	21	
Cleve., Pied.	1196	397.1	33.2	1 1/16	20.09	95.76	24	9
Half & Half	1247	515.0	41.3	1 1/16 f	18.75	111.20	19	8
Cook 1010	1075	442.9	41.2	7/8	19.25	97.90	23	11
Willis	1372	448.6	32.7	1 1/16	20.09	108.59	22	
Acala	1642	601.0	36.6	1	20.71	145.29	4	7
Miller	1454	498.7	34.3	1f	21.09	124.28	15	6
D. &. P. L. No. 4	1463	532.5	36.4	1f	21.09	130.91	15	
D. & P. L. No. 8	1436	555.7	38.7	1	20.71	132.69	12	
Deltatype Webber	1424	448.6	31.5	1 1/4	27.25	141.75	6	3
Delfos 910	1596	510.7	32.0	1 3/16 f	25.81	153.52	1	
Delfos 1374	1554	486.4	31.3	1 3/16 f	25.81	146.89	3	
Delfos 911	1529	510.7	33.4	1 1/16 f	23.81	141.96	5	
Delfos 1341	1460	503.7	34.5	1 1/16 f	23.81	139.06	7	
Delfos 6102	1507	480.7	31.9	1 1/16 f	23.81	134.98	11	1
D. & P. L. No. 6	1519	536.2	35.3	1 3/16	24.81	152.69	2	
Express Lightning	1454	466.7	32.1	1 3/16	24.81	135.53	10	
Lone Star 168	1522	525.1	34.5	1 1/16 f	22.03	135.62	9	
Lone Star 65, Col.	1332	467.5	35.1	1 1/16	21.71	118.78	17	2
Lone Star 65, Ray.	1371	474.4	34.6	1 1/16	21.71	120.92	16	

TABLE 2—COTTON VARIETY TEST—HILL LAND—1927

Variety	Pounds per acre		Lint data			Total Value per acre	Rank in value
	Seed cotton	Lint	Percentage	Length	Cents per lb.		
Trice, Miss. Sta.	1506	518.1	34.4	1	20.71	127.06	8
Cleve. Wann.	1392	526.2	37.8	7/8	19.25	118.61	15
Cleve. 5	1330	468.2	35.2	1	20.71	114.20	19
Cleve., 54	1396	501.2	35.9	7/8 f	19.59	116.08	16
Cleve., Wilson	1231	437.0	35.5	7/8 f	19.59	101.47	24
Cleve., Pied.	1475	528.5	35.9	7/8	19.25	120.67	13
Half and Half	1251	532.9	42.6	13/16	18.38	112.31	21
Cook 1010	1271	523.7	41.2	13/16	18.38	111.20	22
Willis	1360	471.9	34.7	7/8 f	19.59	110.21	23
Acala	1378	511.2	37.1	15/16 f	20.31	121.16	12
Miller	1319	476.2	36.1	1	20.71	115.48	17
D. & P. L. No. 4	1344	506.7	37.7	1	20.71	121.69	11
D. & P. L. No. 8	1469	574.4	39.1	15/16 f	20.31	134.55	4
Deltatype Webber	1260	407.0	32.3	1 3/16	24.81	115.09	18
Delfos 910	1349	457.3	33.9	1 1/8 f	23.81	126.72	9
Delfos 1374	1297	430.6	33.2	1 1/8 f	23.81	119.85	14
Delfos 911	1398	480.9	34.4	1 1/16 f	22.03	124.28	10
Delfos 1341	1419	516.5	36.4	1 1/16 f	22.03	131.83	6
Delfos 6102	1546	533.4	34.5	1 1/16 f	22.03	137.76	2
D. & P. L. No. 6	1509	550.8	36.5	1 1/8	23.31	147.56	1
Express, Lightning	1261	414.9	32.9	1 1/8	23.31	113.64	20
Lone Star 168	1473	531.8	36.1	1 1/16	21.71	134.28	5
Lone Star 65, Col.	1506	533.1	35.4	1 1/16	21.71	135.19	3
Lone Star 65, Ray	1423	503.7	35.4	1 1/16	21.71	127.74	7

Recommendations—For hill land, it has been found that D. & P. L. No. 4, Lone Star 65, Miss. Sta. Trice, Acala, Willis, Cleveland 54, D. & P. L. No. 8 and Miller are all good.

For valley land Delfos 6102 and any of its progenies, D. & P. L. No. 6, Lone Star 65 and Miss. Sta. Trice. If a good premium is being paid for an extra long staple, it would probably be wise to grow Deltatype Webber on the very best bottom lands. It should be borne in mind that very fertile soil maintains length guaranteed for long varieties. Many farmers plant long staple varieties on hill land of low fertility and when selling think the cotton buyer is beating them out of an eighth of an inch or so in stapling when it is really due to growing staple cotton on poor hill land.

The valley land variety test has been conducted for seven years, while the hill land test was started this year. Six hundred pounds of an 8-6-4 fertilizer was used in each case and the cotton was poisoned once. Each test was conducted in four series.

Fertilizers—Practically ninety per cent of our visitors are interested in fertilizers for cotton and appear very much surpirsed to find around ten dollars worth of a complete fertilizer almost doubling the yield of unfertilized cotton on good valley land that normally produced a thousand pounds of seed cotton per acre. One visitor remarked this past season that he used fertilizer on the poorest soils only, thinking that good land did not need it, but he realized now that it had cost him quite a bit by not using fertilizer on the good land too. Judicious use

of fertilizer will increase the yield on any land suitable for the growth of cotton.

In testing kinds of fertilizer, it is a good idea to test quantity also, so as high as 2,400 pounds of a mixed fertilizer per acre has been used on the station with a three year average net gain after paying for the fertilizer of $31.25. All fertilized plots have produced nice profits for the past three years.

According to custom, cooperative fertilizer tests were conducted in 1927. This work was confined to Madison County and was located on the farm of Dr. Boles Smith, near Canton. As will be observed, the results from this test are compiled from the first picking only, due to the fact that stock broke into this field and destroyed the plots to the extent that a second picking would give worthless results. However, it is interesting to note that the first picking increased the yield enough to pay for the fertilizer and then show a net gain, except in the case of where the potash was left out entirely. It is estimated that the figures in the table represent about half the cotton produced.

Below is to be found the general fertilizer test conducted on the Station, also the cooperative fertilizer tests conducted near Canton, Mississippi.

TABLE 3—ANALYSIS TEST—1927

Pounds of material applied per acre				Pounds of seed cotton per acre			Dollars per acre		
Acid phos.	Nitrate of soda	Mur. of potash	Analysis	Plot yield	Check yield	Increase	Increase at 7c.	Cost of fert.	Net gain
No fertilizer				934					
300	160	100	8-4-8	1683	924.50	758.50	53.09	9.33	43.76
300	160	75	8-4-6	1572	915.00	657.00	45.99	8.73	37.26
300	160	50	8-4-4	1404	905.50	498.50	34.89	8.13	26.76
No fertilizer				896					
300	160	25	8-4-2	1402	882.75	519.25	36.35	7.53	28.82
300	160	——	8-4-0	1156	869.50	286.50	20.05	6.93	13.12
300	320	50	8-8-4	1544	856.25	687.75	48.14	12.81	35.33
No fertilizer				843					
300	240	50	8-6-4	1469	864.50	604.50	42.31	10.47	31.84
225	160	50	6-4-4	1429	886.00	543.00	38.01	7.57	30.44
150	160	50	4-4-4	1435	907.50	527.50	36.92	7.00	29.92
No fertilizer				929					
600	320	100	8-4-4	1861	922.75	938.25	65.68	16.26	49.42
900	400	150	8-4-4	2017	916.50	1100.50	70.03	24.39	42.64
1200	640	200	8-4-4	1966	910.25	1055.75	73.90	32.52	41.38
No fertilizer				904					

TABLE 4—COOPERATIVE ANALYSIS TEST, MADISON COUNTY, DR. BOLES SMITH—1927

Pounds of material applied per acre				Pounds of seed cotton per acre			Dollars per acre		
Acid phos.	Nitrate of soda	Mur. of potash	Analysis	Plot yield	Check yield	Increase	Increase at 7c.	Cost of fert.	Net gain
No fertilizer				633.0					
300	160	100	8-4-8	933.0	638.6	294.7	20.63	9.33	11.30
300	160	75	8-4-6	887.1	644.1	243.0	17.01	8.73	8.28
300	160	50	8-4-4	843.5	649.7	193.8	13.57	8.13	5.44
No fertilizer				655.2					
300	160	25	8-4-2	808.0	646.2	161.8	11.33	7.53	3.80
300	160	—	8-4-0	690.0	637.0	53.0	3.71	6.93	-3.22
300	320	50	8-8-4	878.7	627.9	250.8	17.56	12.81	4.75
No fertilizer				618.5					
300	240	50	8-6-4	854.5	615.2	239.2	16.74	10.47	6.27
225	160	50	6-4-4	779.6	611.8	167.8	11.75	7.57	4.18
150	160	50	4-4-4	792.7	608.5	184.2	12.89	7.00	5.89
No fertilizer				605.1					

Note—The above represents the first picking only. Stock destroyed the field before the second picking.

Remarks—The test on the Station was conducted in three series on good valley soil and planted to Lone Star 65 cotton on April 20, 1927. A good stand was secured, which would average around two to three stalks per foot on three and one-half foot rows. The season was fairly favorable except in August when poisoning became necessary to kill the weevil and after one application of calcium arsenate rain fell every day to some extent for three weeks. It is estimated that fifteen per cent damage was done due to the weevil. The Madison County test was also conducted in three series and planted to Lone Star 65 cotton on April 25. A good stand was secured.

It is evident in these tests that each application of complete fertilizer netted cash returns after paying for the fertilizer used. Average results for the past three years indicate that where nitrogen has been increased to six per cent in a fertilizer analysis, the profits increase accordingly. Results point toward the use of eight per cent phosphorus in a fertilizer analysis and it is very evident that some form of potash is needed and at least four per cent is suggested. The formula without potash this past year produced a very small profit, as can be seen in the table.

Recommendations—Use five or six hundred pounds of a fertilizer carrying an 8-6-4 analysis. This may be made approximately by using 200 pounds of 16% acid phosphate, 160 pounds 15% nitrate of soda, and 100 pounds of 12% kainit. Any form of nitrogen or any form of potash may be substituted for the above work, provided the ratio is kept the same in terms of nitrogen and potash. Care must be taken with some forms of nitrogen in not mixing more than enough to put in one day as mechanical changes take place that make distributing difficult.

If the cotton crop follows a heavily fertilized truck crop of the preceding year, it may be safe to cut the phosphorus and potash to half and lower the nitrogen to four per cent. On lands infested with coco

or Johnson grass, apply only half the nitrogen and make side applications with the other half after the cotton has been chopped. Where heavy red clay hillsides are to be used, potash may not be necessary. Fertilizer pays on fertile soil as well as on poor soil and to make "more cotton on less acres," the judicious use of fertilizer will aid to a great extent.

TABLE 5—NITROGEN SOURCES TEST WITH COTTON—1927

Pounds of material applied per acre	Yield on 1-14.063 acre	Pounds of seed cotton per acre			Percent increase	Three year average seed cotton increase pounds
		Plot yield	Check yield	Increase		
No fertilizer	114.78	1614.15				
150 Nit. soda	123.93	1742.83	1599.38	143.45	8.97	282.2
112.5 Sul. ammonia	124.60	1752.25	1584.62	167.63	10.58	235.6
86.5 Leunasalpeter	123.60	1738.19	1569.85	168.34	10.72	279.3*
No fertilizer	110.58	1555.09				
105 Cal. cyanamid	122.40	1721.31	1535.75	185.56	12.08	190.8
150 Cal. nitrate	120.29	1691.64	1516.41	175.23	11.56	248.6
48.9 Urea	118.31	1663.79	1497.08	166.71	11.14	254.3
No fertilizer	105.08	1477.74				

*Leunasalpeter carries two years averages only.

Note—Each carrier equivalent to 150 pounds nitrate of soda.

Remarks—Quite a bit of attention has been given to finding the best nitrogen fertilizer to use in mixing fertilizers. This is the third year that this test has been conducted and as will be seen in the above table, results are tabulated for 1927 and the last column gives the three year average of all sources except leunasalpeter, which is listed as the average for only two years.

This work was conducted in three series and planted to Lone Star 65 cotton on April 20, 1927. All applications were based on twenty-two and one-half pounds of actual nitrogen per acre and the entire test, including checks, received 300 pounds of 16% acid phosphate and 40 pounds of 48% muriate of potash per acre.

The long growing season of the past year was no doubt favorable to the slowly acting nitrogens. Several new sources are certainly promising, however.

Potash Sources—For the past two years tests have been conducted with three forms of potash, namely, kainit containing 12% actual potash, sulphate of potash with 50% and muriate of potash containing 48% actual potash. These tests were conducted in three series and the phosphorus and nitrogen supplied in equal quantities to all plots. The test for 1927 was planted to Lone Star 168 cotton April 28 and an excellent stand was secured, giving the following results in pounds of seed cotton per acre only:-

300 pounds of kainit produced 1,388 pounds

75 pounds of sulphate of potash produced 1,390 pounds, and

78 pounds of muriate of potash produced 1,799 pounds of seed

cotton per acre.

No conclusions should be drawn from the one year's results, however.

In all tests where potash was left out of a formula, it was very noticeable that cotton rusted much earlier in the season and shed all leaves while other plots were still in heavy foliage. At least four per cent of potash should be used in a fertilizer analysis, and if land is used where cotton rusts badly, eight per cent will, in all probability, be beneficial. It is our opinion, after eight years observation, that the healthiest plants are usually found on the plots where nitrogen, phosphorus and potash are used in combination. In other words, a well fed plant is more able to resist disease than the partly or underfed plant.

TABLLE 6—COTTON SPACING TEST—1927

Number of stalks		Yield in seed cotton per acre	Three year average 1925-1927		
Plot	Foot		Stalks per foot	Yield per acre	Rank in yield
164	.88	1622.9	.88	1723.2	5
319	1.72	1707.9	1.59	1807.8	4
420	2.26	1657.4	2.06	1846.5	2
530	2.85	1459.0	2.64	1820.2	3
553	2.97	1678.0	2.74	1894.1	1

Remarks—Close spacing, along with good cotton years and judicious use of fertilizers and varieties, has been responsible for the over production of cotton in the last three years. A three year average indicates that where the number of stalks per foot is increased, the yield of seed cotton is also increased. Of course there is a limit and it must be borne in mind that the poorer classes of soil will stand closer spacing than the fertile valley soils. Quick maturing, medium sized, small leaf varieties will also stand closer spacing in the drill than the slow growing, large leaf varieties.

The above test was conducted in three series with Lone Star 168 cotton planted April 28 on fertile valley soil that had grown two crops of soybeans planted in corn for two years prior. The test was fertilized with 500 pounds of an 8-6-4 fertilizer and one application of calcium arsenate was made for the boll weevil. Rain at this time prevented further poisoning and weevil damage was estimated at about 25%.

Conclusions—A three year average in spacing work indicates leaving two to three stalks per foot in bunches, using three and one-half foot rows on valley land. On hill land, use three foot rows and leave three to five stalks per foot in bunches. More cotton can be made on fewer acres by the proper use of fertilizer, good varieties, practical cultural methods and close spacing as recommended above. Ordinarily, to insure good stands, do not be too hasty in chopping cotton for it is a hard proposition for any hoe hand to cut out a pretty stalk with four to six leaves. Therefore, in leaving these pretty plants, the stand is saved. If grass gets bad, run around every five or six days with a shallow cultivating side harrow and give the strong plants a chance to establish themselves before chopping.

Corn

Mississippi farmers should raise enough food for the home and feed for the livestock and then devote the balance of the time to growing cotton. Cotton made on home raised feed will show greater returns as it furnishes a profitable market for home grown feed. Corn is easily grown and if given half a chance will produce good yields most years. Too many farmers expect corn to "grow wild" as it appears they often plant poor land to this crop. Corn should be planted on the best land on the farm and each row should be planted to soybeans when the corn is planted, or peas planted broadcast at the last cultivation just before tasseling. This past year the state champion corn grower, who lives near Union, Mississippi, produced 178 bushels per acre as an average on three acres. This yield is unusual but most any of us can produce around forty of fifty bushels per acre if we give the corn crop a little attention.

The work here includes variety tests, fertilizer tests and nitrogen sources tests with corn. The variety test consisted of six series and the fertilizer and nitrogen work was in four series each, planted to Cocke's Prolific corn. Due to inroads of the sugar cane beetle, the results of the fertilizer test are being withheld as it is not believed accurate enough to publish. The variety test was planted May 18 and all fertilizer work around May 25.

TABLE 7—CORN VARIETY TEST—1927

Variety	Yield in bushels shelled corn per acre	Percentage of grain	Rank 1927	Average bushels 1922-27	Average rank 1922-27
Mosby, Station	31.7	79.36	12	30.3	8
Mosby, Delta	33.8	81.58	9	30.9	6
Mosby, D. & P. L.	32.6	82.58	11		
Mosby, Lee	27.8	85.89	19		
Mosby, Suttle	33.6	84.25	10		
Cocke's Prolific, Sta.	41.0	82.67	1	33.2	2
Cocke's Prolific, Delta	34.4	79.36	8	30.5	7
Anderson's Choice	31.3	86.11	13		
Hastings	30.7	70.69	15	29.3	9
Johnson's Prolific	31.1	82.08	14		
Delta Prolific	36.0	79.58	5		
Mexican June	35.7	77.58	7	31.5	4
Laguna	37.3	78.19	4	34.5	1
Paymaster, Neal	38.7	80.36	3	31.3	5
Paymaster, Fisher	40.0	81.89	2		
Yellow Dent, Ferguson	29.4	78.92	17		
Yellow Dent, Station	30.1	81.36	16		
Large Golden Dent	28.5	75.00	18		
Whatley Prolific, Raymond	36.0	80.89	5	32.3	3

Remarks—In the above table, the 1827 results will be found in the first three columns of figures. It will be observed that of the nineteen varieties tested there was a difference of 13.2 bushels of shelled corn per acre between the leading variety and the lowest yielding variety. This difference would make a good average acre yield for

the state as a whole, the way most corn is worked or rather—not worked.

The last two columns in the table show a six year average of nine leading varieties and there is a difference in this case between the leader and the trailer of 5.2 bushels shelled corn per acre.

The table speaks for itself as to the best varieties to use. One objection to the Mosbys is that weevils attack them badly in this section, especially if planted early. Cocke's Prolific, Whatley, Laguna, Hastings and Paymaster are good yielders, but Whatley has a very small ear, Paymaster is subject to weevil attack on account of short shucks and Hastings makes too many "nubbings" a dry year. For extra late planting use Mexican June or Laguna.

TABLE 8—NITROGEN SOURCES TEST WITH CORN—1927

Pounds material applied per acre	Bushels ear corn per acre			Per cent increase	
	Plot yield	Check yield	Increase	1927	Two year average
Check	21.4	21.4			
200 Nitrate of soda	37.4	22.8	14.6	64.0	55.1
146.3 Sul. ammonia	30.8	24.3	6.5	26.8	23.9
115.4 Leunasalpeter	35.2	25.7	9.5	37.0	30.5
Check	27.1	27.1			
138.0 Cal. cyanamid	40.8	25.8	15.0	58.1	39.2
200.0 Cal. nitrate	41.4	24.5	16.9	69.0	58.9
65.2 Urea	41.4	23.1	18.3	79.2	60.4
Check	21.8	21.8			

Note—All plots including checks received 300 pounds acid phosphate and 200 pounds of kainit per acre.

Remarks—The last column of figures in the above table represents a two year average of a nitrogen sources test with corn showing the percentage of increase over the check or plot fertilized at the rate of 300 pounds acid phosphate and 200 pounds kainit per acre. All these percentages indicate that nitrogen is very necessary in growing corn. One must be more careful in fertilizing corn than in fertilizing cotton because corn does not require the quantity demanded by cotton and, too, it is hard to show a profit on corn if large quantities are used. Urea, calcium nitrate, and nitrate of soda appear to be leaders in the nitrogen sources test work for corn.

Recommendations—General fertilizer work with corn at this station has given fair results. For general use, a mixture of 100 pounds of acid phosphate, 150 pounds of nitrate of soda, or its equivalent in pounds of nitrogen, and 50 pounds of kainit per acre will probably cover our requirements on corn land. Where good farming and frequent cultivation is to be done, from 50 to 100 pounds of nitrate of soda or sulphate of ammonia, or the equivalent in equal pounds of nitrogen from some other quick acting source, might be profitably used as a side dressing. This side dressing should be applied when the corn is about knee high, just after a good rain, if possible. Any equivalent form of potash may also be used in the place of kainit, provided the price justifies.

Soybeans

More attention should be given soybeans by our farmers. This crop not only produces hay with a high grain content but it also improves the soil. Stock can be carried over the winter on good quality soybean hay and it has come to our attention that some farmers are using this hay alone while making a crop. To get a hay of high feeding value, cut soybeans when in the dough stage. This stage is determined by detecting the first beans which have become colored for maturity. In the case of the Laredo, some of the seed begin to darken at this stage. Every corn field and every field that begins to fall off in production should be planted to soybeans or peas and given a chance to come back.

Six acres planted to Mosby corn and Otootan soybeans on the station attracted quite a bit of attention from visitors during the early fall. This field was planted the latter prat of March, the beans in the row with the corn planted with a duplex hopper, and on September 1 the corn was ready for the crib and the beans had just begun to bloom. The corn could have been harvested and fed and the beans could have been grazed or saved for hay or seed. Dairymen, especially, were impressed while any farmer easily saw where early feed might be had for an emergency.

A variety test planted June 6, 1927, turned out the highest yields of hay in order named in tons per acre: Delta 487, 3.33 tons; Laredo, 3.09; Delta 483 Black, 3.02; Goshen, 3.01; Otootan, 2.66; Delta 483 Olive, 2.48; Wilson 5, 2.01; Delta 488, 1.93; Perking, 1.91; Ebony, 1.89; Biloxi, 1.87; Lexington, 1.79; Virginia, 1.59; Mammoth Yellow, 1.43; Tar Heel Black, 1.26; and George Washington, 1.01. In justice to the Biloxi, we might add that its best and largest plot had to be cut prematurely to secure a site for a new building. The Otootan and Delta 483 Olive suffered the same fate, but were not as badly damaged by a rain that followed before weighings were made.

In a test of row against broadcast planting this past season in which Biloxi beans were used, the yield was 50% higher for broadcasting on good land. This increase may have been due to the growth of weeds, as the row beans had two cultivations. It was noticeable, however, that the size of the main stem was reduced in the broadcast planting.

For general plantings, the following varieties are recommended: Otootan, Goshen, Laredo, Biloxi and the Delta strains. If an extra early bean is desired, the Wilson, Virginia, Peking, Ebony or Lexington might be used. Where hogs gather the crop many farmers prefer the Mammoth Yellow. It shatters badly and this trouble might be expected when the extra early varieties are used unless very close attention is given as to stage of cutting.

Alfalfa

Two fields of Alfalfa were planted in the form of a fertilizer test to determine whether alfalfa could be grown in this section after applying lime. One set of plots was located on the station while the other

was north of Bolton, Mississippi, on the property of Mr. J. L. Gaddis, Jr. Three tons of limestone per acre were applied and the alfalfa was planted the latter part of March.

Crab grass ruined the Bolton plots, but the plots on the station produced a splendid first cutting, but eventually crab grass and dry weather got the advantage and at present very little alfalfa remains. It is our opinion that the late planting kept the root system from getting established before dry weather started and the plants could not combat the inroads of the crab grass. Very probably a fall planting would have given much better results. As a commercial crop, alfalfa will never be grown on the non-lime lands.

Sorghum

A variety test with surghum and other grains of this type was conducted. The tonnage of Gooseneck sorghum appeared to be the greater, while Sagrain led in the production of grain. Highly bred Dorso and Shrock Kaffir were planted on either side of Sagrain and produced excellen yields of grain. There seems to be a very slight difference in these last mentioned varieties, detectible only to the well trained eye, as was evidenced by the remarks of many visitors to the plots this past sason. In another field of low fertility, that normally produces around 20 bushels of corn per acre, a yield of close to 40 bushels of Sagrain heads was secured. Although this crop is hard on soil, it has the good feature of enduring dry weather. Two varieties of millet planted in this test matured earlier than any of the Kaffirs, Feteritas, Shrocks, Dorsos or sorghums.

Tomatoes

This station is located on the northern edge of the trucking section of Mississippi and for that reason we carry on trucking experiments on an extensive scale, in addition to our regular work. Farmers in this section derive quite a revenue from truck.

Due to the importance of the tomato, it has received more attention than the rest or the truck crops. Various tests have been conducted as to varieties, sources of nitrogen, amounts of potash and in determining the best fertilizer analysis to use in producing tomatoes. Some disease work has been done in cooperation with Mr. H. H. Wedgeworth of the State Plant Board. Cooperative nitrogen source work was capably conducted on the station farm by Mr. J. L. Cooley, Jr., a graduate student employed by the Educational Bureau of the Chilean Nitrate Company. These tests follow in tabular form.

TABLE 9—TOMATO VARIETY TEST—1927

Variety	Yields in pounds per acre		Percentage picked early			Average size of shippers, pounds
	Total	Shipping tomatoes	Total	Shipping Tomatoes	Percent of shippers	
Globe	16393	11108	59.7	70.1	67.78	.276
Gulf States	19305	13274	59.0	68.1	68.75	.317
Detroit	16058	10533	58.5	68.8	65.59	.223
Marglobe	16034	11370	57.9	62.3	70.91	.250
Marvel	17686	12801	51.3	60.5	72.37	.248
Norton, Pink	17897	11689	56.1	63.1	65.31	.253
Richards	17380	10838	60.7	71.6	62.35	.262
Crystal Springs Market	16873	10056	62.2	73.5	59.65	.345
Marvelosa	13782	8159	63.9	77.0	59.20	.182
Marvana	18143	12494	60.1	65.2	68.86	.232
Louisiana, Red	15425	10450	56.0	63.0	67.74	.207
Louisiana, Pink	13959	9006	71.3	69.9	64.58	.253

TABLE 10—TOMATO WILT TEST—1927

Variety	Yield in pounds per acre		Percentage picked early			Average size of shippers, pounds
	Total	Shipping tomatoes	Total	Shipping tomatoes	Percentage of shippers	
Globe	14341	10004	30.6	29.4	69.75	.249
Gulf States	17516	11960	33.0	38.1	68.28	.245
Detroit	19068	14099	32.9	35.4	73.97	.277
Marglobe	19584	14990	36.3	38.2	76.54	.256
Marvel	15275	10656	25.9	28.9	69.76	.223
Norton, Pink	17615	11877	44.4	52.2	66.85	.287
Richards	32259	19855	33.9	43.7	61.54	.291
Crystal Springs Market	24608	17660	42.9	50.1	71.76	.284
Marvelosa	21932	14062	29.6	35.3	64.11	.269
Marvana	19342	15132	36.5	38.1	78.23	.235
Louisiana, Red	22168	15456	25.9	26.7	69.72	.224
Louisiana Pink	15886	11440	49.5	52.9	72.01	.233

Remarks—Seed of twelve varieties of tomatoes were planted in the hotbed January 21. On February 15, 16, and 17, the plants were transferred to the cold frames. Leaf spot attacked all five frames and two applications of Fungi-Bordeaux spray four days apart controlled this disease one hundred per cent. The weather, due to rainfall and cold, made extra trouble in handling these frames, as times were very short for exposing the plants for air. The January rainfall on the station was 7.90 inches, February was 1.06 inches and March gave a total of 9.58 inches. The plants were set in the field April 5, 6, and 7, which is indeed late, but rainy weather and wet lands prevented this on an earlier date. The above test was in three series.

The wilt test was put out on April 7 on wilt infested soil. On April 17 a handful of wilt infested soil was put around each plant in the

wilt test to insure infection by this disease.

Conclusions—The Gulf States led in shipping tomateos with a total of 13,274 pounds. The Marvel and Marvana closely followed. In size the Crystal Springs Market came first with an average weight of .345 of a pound, while the Gulf States was second with an average of .317 of a pound. Many truckers mix Globe and Gulf States seed and claim to get a better pack with most of the "shake" eliminated when shipping.

In the wilt test, or the second table listed above, the Richards produced 19,855 pounds shipping tomatoes with the Crystal Springs Market second with a total of 17,660 pounds. The Richard also produced the largest tomatoes with an average of .291 of a pound. The last named variety also produced the highest percentage of early shipping tomatoes in the wilt test, with the Crystal Springs Market a close second. A careful study of the tables will bring out many points that might be of benefit in selecting varieties to use. There was a difference of around two and one-half tons of shipping tomatoes between the leader and the trailer in the main variety test.

TABLE 11—ANALYSIS TEST WITH TOMATOES 1926 AND 1927 (AVERAGE)

Analysis	Yield in pounds per acre		Percent shippers	Percent picked early		Dollars per acre		Net gain
	Total	Shippers		Total	Shippers	Value at 6c	Cost of fert.	
				(1500 pounds per acre)				
10-3-3	14312	7415	57.4	36.8	34.2	534.89	19.74	515.15
8-3-3	14481	9348	61.8	40.3	36.4	560.84	18.05	542.79
8-4-3	15354	9581	60.1	38.5	31.1	574.83	21.01	553.82
8-5-3	15533	10830	67.4	33.1	29.7	649.79	23.96	625.83
				(2000 pounds per acre)				
10-3-3	14901	9860	64.5	42.1	30.9	591.57	26.32	565.25
8-3-3	14945	9601	63.4	39.4	37.7	576.05	24.07	551.98
8-4-3	11979	7527	61.4	36.8	30.9	443.98	28.01	415.97
8-5-3	15599	10946	67.1	34.4	34.9	656.72	31.95	624.77

Remarks—The analysis test was conducted to determine the fertilizer formula best suited to producing tomatoes economically. The test was conducted in three series and the above table represents a two year average. All nitrogen was derived from equal pounds of nitrogen from nitrate of soda, sulphate of ammonia and cottonseed meal. Potash was derived from sulphate of potash. This test has not been conducted long enough to reach any final conclusions, but 1,500 pounds per acre of an 8-5-3 leads in money value with $625.83 per acre as an average for two years.

TABLE 12—AVERAGE RESULTS OF NITROGEN SOURCES TESTS WITH TOMATOES 1924-25-26 AND 27

Source of Nitrogen	Yield in pounds per acre		Percent shippers	Percent picked early		Total value, dollars
	Total	Shippers		Total	Shippers	
	(1500 pounds of an 8-4-3 per acre)					
Nitrate of soda	11329	6328	53.4	41.7	53.3	386.39
Ammonium sulphate	10110	5160	49.4	49.0	56.4	316.57
Combination	10952	6325	54.4	42.8	49.3	386.11
Urea	10500	5969	54.5	45.9	51.8	364.35
Cottonseed meal	11073	5968	51.7	43.9	50.1	365.39
	(2000 pounds of an 8-4-3 per acre)					
Nitrate of soda	11382	6216	52.5	45.5	52.8	381.01
Ammonium sulphate	11645	6207	51.3	47.9	55.3	379.65
Combination	12476	6355	50.5	47.0	54.6	390.44
Urea	12374	6876	54.1	47.4	54.0	419.64
Cottonseed meal	11985	6620	53.8	43.6	50.6	405.35

Remarks—The above test was conducted to determine the best source of nitrogen to use in a fertilizer formula for producing tomatoes commercially. Where a combination is listed it means the nitrogen was derived from equal pounds of nitrogen from nitrate of soda, sulphate of ammonia and cottonseed meal. The other nitrogen used was derived from the sources indicated, phosphorus from acid prosphate and potash from sulphate of potash.

The above table represents a four year average and the past season's work was conducted in three series. Urea appears to be the leading source in this test and where 2,000 pounds per acre of an 8-4-3 using Urea as the source of nitrogen, was used, the average net gain for four years was $419.64. The cottonseed meal plot at the same rate gave $405.35. In the 1,500 pound application nitrate of soda gave $386.39 and the combination $386.11. More data must be secured before a definite recommendation can be made as several sources are close together and look promising.

TABLE 13—RESULTS OF NITROGEN SOURCES AND RATE TEST WITH TOMATOES—1927

Amt. per acre of an 8-4-3	Source of Nitrogen	Side application, lbs. per acre	Yield per acre pounds		Per-cent ship-pers	Percent picked early		Total value dollars
			Total	Ship-pers		Total	Ship-pers	
1000	Nitrate of soda	200 Ni. So.	17527	12404	70.7	43.0	43.8	744.24
1000	Cottonseed meal							
	Nitrate of soda	200 Ni So.	16073	11170	69.4	46.3	49.6	670.20
1000	Cottonseed meal	150 Am.						
	Ammonium sulphate	Sul.	16929	11150	65.8	47.1	50.3	669.00
1000	Cottonseed meal	200 Ni. So.	17486	12388	70.8	46.7	47.2	743.28
1000	Nitrate of soda		18301	12083	66.2	46.9	53.2	724.98
2500	Nitrate of soda		19441	13928	71.1	44.7	47.2	835.68
3000	Nitrate of soda		15161	10523	69.4	47.2	48.1	631.38
1500	Nitrate of soda							
	Cottonseed meal		20339	14522	71.4	52.1	53.3	871.32
1500	Ammonium sulphate							
	Cottonseed meal		16290	10473	64.2	48.2	52.8	628.38
2000	Nitrate of soda							
	Cottonseed meal		17982	11847	65.8	52.5	57.5	710.82
2000	Ammonium sulphate							
	Cottonseed meal		18304	11403	62.2	54.1	59.9	684.18

Remarks—This is the first year that this test has been conducted. Mr. J. L. Cooley, Jr., a graduate student employed by the Educational Bureau of the Chilean Nitrate Company, handled this project as part of the special work required toward his degree. Mr. Cooley's other capable assistant has previously been acknowledged.

The prime object of this thest was to determine whether large quantities of nitrate of soda used under the plant caused the tomatoes to crack, from "puffs," cause irregular fruit and also to determine keeping qualities after long express shipments. Side applications of nitrogen fertilizers were also used ten days before first picking to determine effect on early shippers.

Two shipments of four crates each from plots using an 8-4-3 formula, where nitrate of soda was the only source of nitrogen at the rates of 1,000, 2,000, 2,500 and 3,000 pounds per acre, were shipped by express to the Bureau of Agricultural Economics, U. S. Department of Agriculture, New York City, for a careful and rigid inspection. These reports were made at intervals and only six puffy tomatoes were reported out of eight crates. Ten growth cracks were found and only one wormy tomato. The two heavy applications were reported better than the two lighter in both shipments. On ripening, the tomatoes had a good deep red color and smooth texture and presented an attractive appearance. Very few shriveled tomatoes were reported. After such a long shipment by local express, the crates being handled many times, crate marks and box scars were expected. These were comparatively few however. There were thirty-seven bacterial rots out of 633 tomatoes shipped to New York City, which might be considered a good report.

The above test was planted in three series. One year's results should not be taken too seriously, but the results of this test are cer-

tainly encouraging. This work, in all probability, will be continued another year.

TABLE 14—AVERAGE RESULTS OF POTASH TESTS WITH TOMATOES
1924-25-26 AND 27

Analysis	Yield in pounds per acre		Percent shippers	Percent picked early		Dollars per acre		
	Total	Shippers		Total	Shippers	Value at 6c.	Cost of fert.	Net gain
				(1000 pounds per acre)				
8-4-0	14001	7290	52.2	42.1	50.2	447.79	10.44	437.33
8-4-3	14810	7633	50.7	52.6	45.9	468.98	12.00	456.98
8-4-6	15856	7062	44.7	48.0	51.1	435.25	13.56	421.69
				(1500 pounds per acre)				
8-4-0	15253	7724	50.2	44.2	50.0	474.60	15.66	459.19
8-4-3	13816	7093	50.9	49.4	44.5	435.80	18.00	417.80
8-4-6	13940	7821	55.3	43.4	44.9	477.20	20.34	456.86
				(2000 pounds per acre)				
8-4-0	14717	7448	50.6	42.0	47.8	457.55	20.88	436.92
8-4-3	15449	8166	50.4	48.0	48.9	485.01	24.00	461.01
8-4-6	13953	6919	49.3	43.2	43.9	425.49	27.12	398.37

Remarks—The above table represents a four year average. The motive in this test is to determine the most economical amount of potash to use in growing tomatoes. Muriate of potash was used in all formulae, nitrogen was derived from the above mentioned combination and phosphorus from acid phosphate. The test covered three series this past year.

We feel safe in recommending at least three per cent of potash in fertilizers for tomatoes. It is our opinion that with potash present in the analysis, the nitrogen and phosphorus are in position to be more available. From observations, a more stockily built plant and a better colored fruit results from the use of some potash.

English Peas

TABLE 15—AVERAGE RESULTS OF ENGLISH PEA FERITILZER WORK
1924-25-26 AND 27

Analysis	Yield per acre pounds	Dollars per acre		
		Value at 5c	Cost of fertilizer	Net gain
		(1000 pounds per acre)		
10-3-3	3716	182.05	11.59	170.46
8-3-3	3054	152.70	10.49	142.21
8-4-3	3026	151.29	12.00	139.29
		(1500 pounds per acre)		
10-3-3	3380	168.98	17.39	151.59
8-3-3	3565	173.23	15.74	162.49
8-4-3	3280	163.98	18.00	145.98

TABLE 16—AVERAGE RESULTS OF NITROGEN SOURCES TEST WITH ENGLISH PEAS 1924-25-26 AND 27

Rate per acre of an 8-4-3, lb.	Yield pounds per acre using		
	Nitrate fo soda	Sulphate of ammonia	Combination
1000	4170	4035	2980
1500	3918	4176	3279

Remarks—Tables 15 and 16 represent a fertilizer test to determine the best analysis and the source of nitrogen to use in growing English or green peas for the market. These tests were conducted in two series and the Thomas Laxton pea was used. All nitrogen in the first table was derived from the above named combination, while the latter table designates the source of nitrogen used. Both tests were planted February 10, 1927.

The tables show a four year average and indications point toward 1,000 pounds per acre of a 10-3-3 fertilizer. The nitrogen test is slightly in favor of nitrate of soda. This, however, seems immaterial.

Variety Work with English Peas—This is the first year that a variety test with English peas has been conducted. Six varieties, the World's Record, Blue Bird, Thomas Laxton, Alaska, Hundredfold and Prince Edward, were planted February 10, in three series. The Alaska did not come true to name and was discarded from the test. The entire test was fertilized with 1,000 pounds of a 10-3-3 fertilizer per acre, using the combination for the source of nitrogen and sulphate of potash for the potash.

At the first picking, the Blue Bird variety gave in yield 5.5 (28 pounds) hampers more per acre than the World's Record, or next highest, and 31.5 hampers more per acre than the Thomas Laxton, or third highest. The World's Record is slightly larger than the Blue Bird and both are smaller than the Thomas Laxton, which is still smaller than the Hundredfold, a late, stunted, vigorous growing variety. At the first picking, April 15, the Prince Edward, a very tall, vigorous growing variety, was in full bloom with no young pods at all. It is evident that for the early market the Hundredfold and the Prince Edward will not be satisfactory. The Thomas Laxton is used extensively in this section by the truckers on account of the size of the pod and the flavor.

On April 19, the second picking was made. Pod rot was very prominent on the Blue Bird, some on the World's Record and to some extent on the Hundredfold. The Prince Edward was still in full bloom with no pods in sight at the second picking.

Four pickings were made with the following results in pounds per acre: World's Record, 4,349; Thomas Laxton, 4,194; Blue Bird, 3,865; Hundredfold, 3,336; and the Prince Edward only produced 250 pounds of peas per acre during this time. On account of the size of the pod and the resistancy to disease, we slightly favor the Thomas Laxton for the commercial crop. Further experiments along this line will be conducted in the future.

We wish to acknowledge the cooperation of Lotterhos & Huber,

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Crystal Springs, Mississippi, in this variety work. This progressive firm furnished all the seed for the variety test except the Alaska.

Snap Beans

TABLE 17—AVERAGE RESULTS OF SNAP BEAN FERTILIZER TEST, 1924-25-26 AND 27

Analysis	Yield pounds per acre,	Dollars per acre		
		Value at 5c	Cost of fertilizer	Net gain
		(1000 pounds per acre)		
10-3-3	4371	218.53	11.59	206.94
8-3-3	3950	197.49	10.49	187.00
8-4-3	3893	201.40	12.00	182.65
		(1500 pounds per acre)		
10-3-3	4130	206.50	17.39	189.11
8-3-3	4056	202.79	15.74	187.05
8-4-3	4377	220.08	18.00	202.08

TABLE 18—AVERAGE RESULTS OF NITROGEN SOURCES TESTS WITH SNAP BEANS 1924-25-26 AND 27

Rate per acre of an 8-4-3, lbs.	Yield pounds per acre using		
	Nitrate of soda	Sul. of ammonia	Combination
1000	3844	4081	3837
1500	4298	4480	4210

Remarks—The above tables represent an average of the four years work with snap or green beans. The combination was used in securing the nitrogen in Table 17, while in Table 18 the nitrogen was derived as indicated. The Red Valentine bean was used. The test was conducted in two series and planted March 16, 1927.

Results appear to favor 1,000 pounds per acre of a 10-3-3 fertilizer, using sulphate of ammonia as the source of nitrogen. However, the 1,500 pound application of an 8-4-3 is a close second.

Sheep manure, analyzing 2-1¼-2 was used against an 8-4-3 under beans. Twenty-five cents worth of each fertilizer was used on each plot with the following results in pounds per acre: Commercial sheep manure, 1,775, and the 8-4-3 fertilizer 5,765. The Italian truckers near Vicksburg use sheep manure quite a bit, hence this little test.

Irish Potatos

More attention should be given to the source of seed when planting an Irish potato crop. To impress this feature, this station has cooperated with the State Plant Board, in which Mr. H. H. Wedgeworth has secured certified seed from northern growers to test against seed secured locally. Disease work with this crop was studied by the Plant Board and a report of this may be had in Circular No. 75, which may be obtained from the Experiment Station, A. and M. College, Mississippi. Below is a table giving the yield produced in this test.

TABLE 19—IRISH POTATO SEED SOURCE TEST—1927

Source of Seed	Variety used	Bushels per acre			
		Diameter in inches			
		2 or more	1½ to 2	Culls	Total
Jackson, Mississippi	Triumph	55.2	45.0	23.0	123.2
Montana Expt. Sta., Bozeman	Triumph	39.2	44.3	23.2	106.7
Alliance, Nebraska	Triumph	40.2	50.4	22.0	112.6
Williamstown, Vermont	Cobbler	55.2	35.3	15.9	106.4
Kirksville, New York	Cobbler	60.5	45.1	17.4	123.0
Alliance, Nebraska	Cobbler	54.4	28.5	32.9	115.8
Montana Expt. Sta., Bozeman	Triumph No. 1	43.9	53.9	25.3	123.1
Charlevoix, Michigan	Cobbler	61.1	39.5	15.1	115.7
Red Stone, Montana	Triumph	38.7	53.2	24.4	116.3
Montana Expt. Sta., Bozeman	Triumph No. 2	50.9	68.3	26.4	145.6
Moorehead, Minnesota	Triumph	45.6	55.0	27.5	128.1
Washburn Maine	Cobbler	72.9	46.2	17.7	136.8
Vicksburg, Mississippi	Triumph	26.6	41.5	17.6	85.7

Cabbage Fertilizer Test

Net returns on cabbage as a truck crop were excellent this past season. This has resulted in larger plantings this winter. A small fertilizer test to determine quantity of fertilizer to use per acre was conducted on the station this past season. A 10-4-4 fertilizer was used with the following results: 1,000 pounds per acre produced 13,818 pounds of cabbage; 1,500 pounds per acre yield 12,917 pounds and 2,000 pounds per acre gave a yield of 12,098 pounds of cabbage per acre. As the quantity of fertilizer was increased per acre, the size of each head of cabbage increased.

Based on the above data and results in the past, we feel that 1,500 pounds of a 10-4-4 fertilizer per acre can be profitably used. The nitrogen in the above test was derived from equal pounds of nitrogen from nitrate of soda and sulphate of ammonia. Disease work was also conducted with cabbage by Mr. H. H. Wedgeworth of the State Plant Board. Various seed treatments were used to check or control diseases before the seed were put in the hotbed.

General Work

Rotations—It is our policy to grow a legume on all lands at least once a year. Several rotations are under way and outstanding among these is the two year rotation with cotton, vetch, corn and soybeans. This keeps a legume on the land summer and winter and does not interfere materially with either crop.

To start this, at the last cultivation of cotton, sow broadcast seventeen to twenty pounds of vetch seed to the acre. This germinates in the fall and matures seed around the middle of May and the first year must be turned under to insure a volunteer crop the following fall. After turning under, plant the land to corn and soybeans. As stated, the vetch volunteers and in the spring may be turned under or cut for

hay, as desired, and then planted to cotton. Permit vetch to mature seed every other year and be insured of a volunteer stand every year. In this connection, bur clover will also reseed itself and may be used in a similar rotation.

Vetch has been grown on very poor white land on the station and has about trebled the yield of soybeans for hay on these lands. It should be borne in mind, however, that vetch does better on good land, so to be successful with vetch plant it on good soil and give it a chance. In another field on very thin soil, the land without vetch or fertilizer produced 350 pounds of seed cotton per acre, where vetch alone was turned under the yield was 667 pounds and where 500 pounds of an 8-4-4 was applied after vetch had been turned under the yield was 1,157 pounds seed cotton per acre. This test was conducted in two series and planted to Lone Star 65 cotton on May 16.

Legumes—Much benefit has been derived from using bur clover, vetch and crimson clover as winter legumes. Crimson clover is an annual and must be planted each year. As stated above, vetch and bur clover will reseed themselves if premitted to mature seed once every two years. Austrian winter peas are being successfully grown as a winter cover crop on the station this year.

Soybeans, velvet beans, peas and lespedeza comprise the best summer legumes for this section. Lespedeza reseeds while the others must be planted each year. These legumes fit into rotations nicely and are recognized as excellent soil builders.

Pastures—Good pastures are easily obtained in this section by getting a start of bermuda, carpet grass and lespedeza. Some pastures have good white clover and in the wet places paspalum can be found. Any part of this section is well suited to dairying provided there is a nearby market, not over fifty miles away. Grazing periods are long and many cattle in this section are never housed during the winter and when any are housed it is for a very short period, during cold rainy spells. Carpet grass, lespedeza and bermuda are native in this section.

Orchards—A nice young orchard has been started and results show that with a little attention given to pruning, spraying and cultivation, anyone can produce excellent fruit. Vetch grows profusely in our orchard and contributes liberally toward the fertilizing program for the trees. This vetch was started five years ago and volunteers each year.

Boll Weevil Work—Hibernation and emergency work with the boll weevil has been done in cooperation with Mr. O. M. Chance of the State Plant Board. At present there are cages in the woods and cages in the open fields where five hundred weevils have been placed in each cage. These cages are watched daily throughout the emergence period and records are kept to determine the percentage of emergence during the season. Several cotton states are doing this work. Two weevils emerged this past year on April 3 on this station.

Improvements—Many improvements have been made on the station during the past year. A new four-room tenant house has been constructed. Most of this house was built from lumber salvaged from the foreman's old house. A concrete cattle-gap has been installed at the

entrance to the station. The director's residence and garage has been painted. An office building has been constructed of hollow tile and stucco to conform with a general program of branch station offices. Funds would not permit ceiling and plastering this new building, so a complete external job was done so as not to hurt the general appearance of the station and this other work will be done when funds become available. A new wagon has been bought for the station farm. Landscaping has come in for its share of attention and people traveling the new concrete highway into Jackson make many favorable comments as to the beauty of the place.

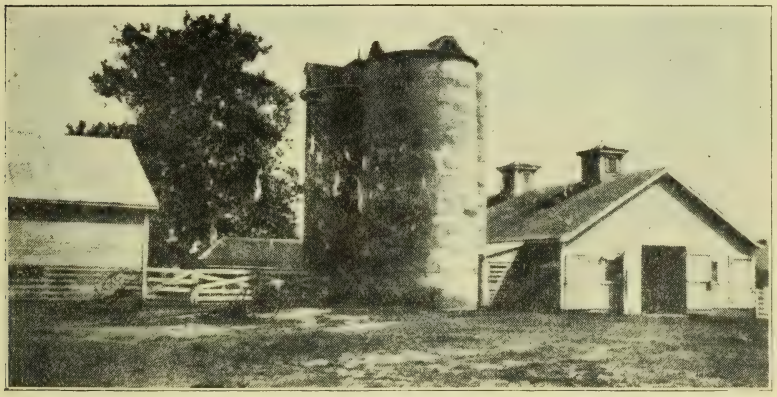
Conclusions—A successful year's work has come to a close. Many visitors have come to the station during the past season. We wish to express appreciation to Dr. B. M. Walker, President of the A. and M. College, and to Director J. R. Ricks of the Experiment Station for the kind and business-like manner in which they have directed the work of the Raymond Branch Experiment Station.

BULLETIN NO. 253 DECEMBER, 1927

REPORT
HOLLY SPRINGS BRANCH EXPERIMENT STATION 1927

By

C. T. AMES AND OTIS B. CASANOVA



Station Dairy Barn

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION

A. and M. College, Mississippi

J. R. Ricks, Director

Report Of Holly Springs Branch Experiment Station 1927

The work of the Holly Springs Branch Station has been conducted along the line towards the development of successful and progressive agriculture for this section of the state. While this station is located only about twenty miles south of the Tennessee line, the soils are very similar for more than 200 miles south of this place. This section is known as the Brown Loam Area. Results obtained from experiments with fertilizers conducted for several years in the northeastern hill section of the state, including the Pontotoc Ridge, indicate very similar soil requirements. More work has been done this season than any time within the past history of this station. The effect of the work done here can be seen on many farms in the state in the use of fertilizers, varieties of farm crops, spacing of cotton, cultural methods of farm crops and in dairying and poultry work.

The seasons the past year have not been very favorable for crops, due to too much rain during the early spring and summer. This section was in the edge of the rain belt that caused the greatest overflow in the Mississippi Valley within the past history of this country.

INSECT DAMAGE

On highly fertilized lands of the station planted to cotton, the cotton hopper destroyed the bottom crop and the boll weevil destroyed most of the top crop, leaving only the middle crop for harvesting. The seasons were ideal for boll weevils and they did heavy damage. Presquare poisoning was not done as only a few weevils were found early in the season. It is felt that if a mixture of two pounds of sulphur to one pound of calcium arsenate, as recommended by Mr. Coad of the U. S. Government Insect Control, had been dusted at the first squaring of the cotton, both the cotton hopper and the boll weevil damage would have been greatly reduced. After the infestation reached 10%, calcium arsenate was dusted on the plants, but poor results were obtained due to the poison being washed off by the frequent showers. The growing season for cotton was three weeks later than usual this year. Unless we have cold weather, near zero, of several days duration this winter, a heavy infestation of weevils may be expected in the spring.

DRAINAGE

Controlling surface water on the farms of the South is of first importance. The growing of legumes and the use of farm manures will avail but little when surface water is uncontrolled. After fencing a farm, the first work should be to control surface water on all lands, including those used for pasture. County agents are ready to assist in this work. Hill soils will rapidly decrease in fertility when cultivated, regardless of the care used in running off rows, if terraces with slight fall are not used to conduct the excessive water slowly to the main drains during a heavy rain. This work is inexpensive and should supersede all other work on the farm. Any land in the state can be

terraced between the time the crops are gathered in the fall and the time to plant the next crop in the spring, with the labor and teams used in cultivating the land.

SOIL IMPROVEMENT

Soil improvement has always had special attention at this station. Almost every acre on the farm grows either a summer or a winter legume each year. Soybeans are grown in all plantings of corn and either winter vetch, crimson clover or Austrian winter pea is grown with small grain in all cotton middles and after hay crops.

Special attention has been given to the use of fertilizers under cotton, corn, sweet potatoes and other crops, also cotton spacing tests, varieties of cotton, corn, potatoes, sorghum, lespedeza, vetch, soybeans, stock beets, fruits, pecans and other crops. Fertilizer tests with alfalfa, including both spring and fall plantings have also been made.

Dairying, poultry and pasture making have had their places in the year's work.

COTTON

The requirements for growing cotton successfully are: a fertile soil, the judicious use of fertilizers, proper cutural methods adapted to the several cotton growing sections and insect control. The public is in a very receptive mood for using improved methods, as can be seen in increased crop yields.

Hill or rolling land should not be broken in the fall unless seeded to a winter cover crop. If not planted to cover crops, it is advisable to leave all of the vegetable matter on the surface during the winter rains to check soil washing. Sod land can be turned in the fall and left rough. Valley land may be broken in the fall if the surface water is properly controlled. Deep plowing on hill land in the fall will not prevent soil washing in this section. A winter cover crop gives the best protection for all kinds of land during the winter months. The dairy cow can be grazed on such crops when the condition of the soil will permit.

Preparation of Land—There are several ways land may be prepared for cotton. One way is to run a furrow down the water furrow of the old rows and throw two furrows together on this furrow, or list the land. Fertilizer is applied in or on this list ten days or two weeks before planting time. Then break the middles out with a buster and allow the land to remain in this condition until planting time. At planting time harrow down to slightly elevated rows ahead of the planter.

The second way is to turn the land broadcast. About two weeks before planting time, lay off the rows and apply the fertilizer, which may be done with the same machine. The row is completed by throwing out the middles with a buster. Horrow and plant as given above.

The third and last way suggested is to put the land in rows at any time before planting, harrow down and apply the fertilizer in the top of the row, cover with a harrow and allow to remain until planting time. At planting time harrow ahead of the planter.

An ideal seed bed is one prepared and fertilized two weeks be-

fore planting time and settled by a rain. In practice it is frequently the case that preparation, fertilization and planting is, of a necessity, done at very short intervals.

Cotton Planting Time—In this latitude the time to plant cotton is usually between April 25 and May 10. Cotton should be planted when the ground is warm enough to cause quick germination. A good stand and earliness are very great factors in the amount produced. It is better to plant medium early and secure a good stand than to plant early and get a poor stand. Late plantings and good stands are very unsatisfactory, often causing a failure in the crop. One of the cheapest and best ways to increase the yield of cotton per acre is to get a good stand of cotton.

A good stand on hill land is from three to four stalks in bunches per foot.

A good stand on valley land is two to three stalks in bunches per foot.

A properly balanced fertilizer is necessary to secure the best results with the above spacing. From our past results, blocking the cotton and having the blocks about twelve inches apart is not very far from good spacing.

Depth of Planting—Cotton seed should be planted very shallow in a medium elevated row. It is advisable to use from one and one-half to two bushels of seed per acre. The earlier the planting is made the more seed should be used. A good practice is to run the planter twice down each row, using half the quantity of seed each way. The first trip will plant the seed a little deeper than the second. This method will increase the chances for a stand, which is one of the greatest factors in the production of cotton.

Cultivation—As soon as the plants are established sufficiently not to be injured, cultivation should begin. Thin or block out as soon as possible and give frequent, shallow cultivation. The practice of this station is to cultivate as soon a spossible after each rain, but if the rains are far apart it may be necessary to cultivate more often—something like once every ten days or two weeks.

Boll Weevil Control—If any weevils can be found just as the first squares are about half grown, calcium arsenate applied in the bud of the cotton will kill them. (The Association of Southern Agriculturalists suggests twenty weevils per acre before poison is used.) Either the sweet poison or the dust form will do the work. Calcium arsenate applied in the dust form, either with hand or power machine, is very satisfactory. A second application about ten days later should be made if any weevils can be found. Results from this station indicate that in this latitude this second application is usually due about the time most of the weevils are out of hibernation, which means that most of the weevils are destroyed. Our results in 1923 warrant this conclusion and this year was somewhat similar in rainfall to 1923. It is felt that a mistake was made this year in not using the pre-square method of poisoning. Should the weevils become plentiful later in the season, poisoning should begin with calcium arsenate dust as soon as 10% squares infestation is found. Mr. B. R. Coad of the U. S.

Department of Insect Control, recommends three applications four days apart, beginning with 10% infestation. After the three applications, the weevils should be held down to about 20% infestation by later dustings.

VARIETY TESTS

Two variety tests were made, one on valley and the other on hill land. The soil used in the valley land test was improved brown loam. The hill test was on brown loam table land of ordinarily fertility. Each variety was planted in one-row plots, repeated four times. The valley test rows were 123 feet long and the hill test rows were 200 feet long.

Plantings were made April 26 and 27. The seasons were unfavorable for cotton, spring and summer being wet. Frost was about three weeks late. The cotton hopper and boll weevils did considerable damage.

Fertilizer—Both plantings were fertilized with 600 pounds of an 8-4-4 home mixture fertilizer applied under the seed before planting.

The following tables, 1 and 2, give results of these tests.

TABLE 1—COTTON VARIETY TEST, VALLEY LAND

Variety	Pounds per acre		Lint data			Total value per acre	Rank in value	Percent seed cotton first picking
	Seed cotton	Lint	Percent	Length	Cents per lb.			
Miss. Stat. Trice	2173.3	639.0	29.4	1 1/16	21.71	164.73	3	37.9
Cleve. Wann.	1528.1	521.1	34.1	7/8 f	19.59	119.20	27	17.9
Cleve. 5	1535.7	497.6	32.4	1 1/16 f	22.03	127.27	22	18.3
Cleve. 54	1636.9	528.7	32.3	15/16 f	20.31	126.22	23	24.4
Cleve. Wilson	1667.3	515.2	30.9	15/16	20.09	123.09	26	29.9
Cleve. Piedmont	1679.9	532.5	31.1	15/16	20.09	124.68	24	28.5
Half and alf, Mahon	1571.7	594.1	37.8	13/16 f	18.75	127.89	20	27.8
Cook 1010	1583.8	612.9	38.7	7/8	19.25	134.49	16	24.4
Willis	1710.3	540.5	31.6	15/16	20.09	128.48	19	23.8
Acala	1642.0	559.9	34.1	1	20.71	134.36	17	25.4
Miller	1773.5	587.0	33.1	1f	21.09	143.97	11	29.0
D. & P. L. No. 4	1424.4	512.8	36.0	1f	21.09	123.65	25	15.6
D. & P. L. No. 8	1442.1	540.8	37.5	1	20.71	127.32	21	20.2
Deltatype No. 5	1447.2	432.7	29.9	1 1/4	27.25	135.16	15	16.4
Delfos 910	1672.3	515.1	30.8	1 3/16 f	25.81	152.62	7	39.0
Delfos 1374	1968.3	570.8	29.0	1 1/8 f	25.81	171.08	2	32.5
Delfos 911	1760.9	526.5	29.9	1 1/8 f	23.81	146.34	10	37.8
Delfos 1341	1771.0	561.4	31.7	1 1/8 f	23.81	154.23	6	38.0
Delfos 6102	1932.9	577.9	29.9	1 1/8 f	23.81	160.64	5	36.3
D. & P. L. No. 6	1444.6	482.5	33.4	1 3/16	24.81	136.07	14	30.5
Express, Light.	1685.0	519.0	30.0	1 1/16	24.81	148.58	9	62.4
Lone Star 168	1798.8	582.8	32.4	1 1/16 f	22.03	149.06	8	35.6
Lone Star 65	2001.2	650.4	32.5	1 1/16	21.71	164.16	4	42.1
Delfos No. 2	1763.4	530.8	30.1	1 1/16 f	22.03	137.89	12	29.7
Acala No. 5	1530.7	543.4	35.5	1f	21.09	131.38	18	27.6
Acala No. 8	1669.8	561.1	33.6	1f	21.09	137.19	13	31.5
Stoneville No. 1	2099.9	707.7	33.7	1 1/16	21.71	177.31	1	33.7

TABLE 2—COTTON VARIETY TEST, HILL LAND

Variety	Pounds per acre		Lint data			Total value per acre	Rank in value	Percent seed cotton first picking
	Seed cotton	Lint	Percent	Length	Cents per lb.			
Miss. Sta. Trice	1185.9	397.3	33.5	1	20.71	95.68	25	76.5
Cleve. Wann.	1053.6	394.0	37.4	7/8	19.25	87.06	27	63.4
Cleve. 5	1201.0	417.9	34.8	1	20.71	99.86	21	56.6
Cleve. 54	1194.3	428.8	35.9	7 1/8 f	19.59	97.01	24	65.9
Cleve. Wilson	1170.8	408.6	34.9	7/8 f	19.59	93.00	26	66.9
Cleve. Piedmont	1085.4	382.1	35.2	7/8	19.25	85.51	28	65.4
Half & Half, Mahon	1338.3	567.4	42.4	1 3/16	18.38	117.40	3	70.7
Cook 1010	1299.8	542.0	41.7	1 3/16	18.38	112.49	10	66.7
Willis	1336.7	457.2	34.2	7/8 f	19.59	104.50	16	66.5
Acala	1284.7	472.8	36.8	1 5/16 f	20.31	109.83	13	64.9
Miller	1244.5	434.3	34.9	1	20.71	103.71	17	58.9
D. & P. L. No. 4	1165.8	432.5	37.1	1	20.71	102.04	19	59.5
D. & P. L. No. 8	1142.4	443.3	38.8	1 5/16 f	20.31	101.91	20	60.7
Deltatype Webber	1117.2	348.6	31.2	1 3/16	24.81	99.55	22	49.3
Delfos 910	1288.1	425.1	33.0	1 1/8 f	23.81	115.89	6	66.7
Delfos 1374	1407.0	454.5	32.3	1 1/8 f	23.81	124.41	1	66.9
Delfos 911	1324.9	446.5	33.7	1 1/16 f	22.03	113.29	9	71.6
Delfos 1341	1318.2	464.0	35.2	1 1/16 f	22.03	116.74	5	72.3
Delfos 6102	1381.9	461.6	33.4	1 1/16 f	22.03	117.34	4	64.4
D. & P. L. No. 6	1194.3	438.3	36.7	1 1/8	23.31	115.02	7	68.6
Express, Light.	1212.7	400.3	33.0	1 1/8	23.31	107.10	15	82.0
Lone Star 168	1271.3	453.9	35.7	1 1/16	21.71	112.44	11	70.6
Lone Star 65	1261.3	449.0	35.6	1 1/16	21.71	111.29	12	68.7
Delfos No. 2	1190.9	394.2	33.1	1 1/16	21.71	99.12	23	67.5
Acala No. 5	1226.1	464.7	37.9	1	20.71	109.18	14	62.2
Acala No. 8	1206.0	435.4	36.1	1	20.71	103.27	18	67.5
Stonville No. 1	1442.2	513.4	35.6	1 f	21.09	124.22	2	72.5
Stoneville No. 2	1273.0	474.8	37.3	1 f	21.09	113.71	8	75.9

Cotton Variety Test—Five Year Average, 1923-27—There is no doubt but that the careful selection of varieties of cotton and the judicious use of the proper fertilizer will add to the income of the grower more than anything else under their control.

Tables 3 and 4 give the average pounds of lint cotton for five years on both valley and hill land tests, also the average money value and the length of staple and percent of lint for 1927. The varieties are placed in the tables in the order of their money value.

TABLE 3—COTTON VARIETY TEST, VALLEY LAND, FIVE YEAR AVERAGE

Variety	Lint data			Value lint and seed
	Yield	Per-cent	Length	
Delfos 6102	544.3	29.9	1 1/8 f	149.77
Delfos 631	516.6	31.3	1 3/16	147.61
Lone Star 65	582.2	32.5	1 1/16	144.51
Miss. Sta. Trice	538.9	29.4	1 1/16	136.75
Willis	585.5	31.6	1 1/16	131.30
Deltatype Webber	432.7	29.9	1 1/4	129.65
Cleve. Wann.	496.6	34.1	7/8 f	129.15
Express, Light.	359.5	30.8	1 3/16	129.15
D. & P. L. No. 4	614.5	36.0	1 f	124.53
Cleve. 54	513.9	32.0	1 1/16 f	123.78
Half & Half, Mahon	579.8	37.8	1 1/16 f	122.75
Miller	549.0	32.1	1 f	119.43
Acala No. 5	541.7	35.5	1 f	119.04
Cleve. Piedmont	496.6	31.7	1 1/16	110.06

TABLE 4—COTTON VARIETY TEST, HILL LAND, FIVE YEAR AVERAGE

Variety	Lint data			Value lint and seed
	Yield	Per-cent	Length	
Delfos 631	400.3		1 3/16	113.26
Delfos 6102	435.4	33.4	1 1/16	113.03
D. & P. L. No. 4	498.2	37.1	1	112.74
Lone Star 65	453.1	35.6	1 1/16	106.72
Express, Light.	387.1	33.0	1 1/8	106.12
Acala No. 5	435.2	37.9	1	104.18
Willis	452.5	34.2	7/8 f	104.06
Miss. Sta. Trice	428.3	33.5	1	102.79
Half & Half, Mahon	478.6	42.4	1 1/16	101.21
Miller	398.3	34.9	1	96.45
Deltatype Webber	323.1	31.2	1 3/16	95.90
Cleve. 54	411.5	35.9	7/8 f	93.64
Cleve. Piedmont	388.3	35.2	7/8	87.45
Cleve. Wann.	401.9	37.4	7/8	86.04

The five year average given in Tables 3 and 4 should assist in making selections of varieties for this section. It will be seen that Delfos 6102 and 631 rank first and second on both hill and valley land. If a staple cotton is desired either of these varieties is good. Lone Star 65 comes third in money value on valley land and D. & P. L. No. 4 third on hill land. Lone Star 65 ranks fourth on hill land. Lone Star 65 is especially good on upland. It is a good, strong cotton, dwarf, big boll, early maturing, a good storm cotton and easy to pick. This variety was first in money value the wettest year on record, 1923, and second the dryest year on record, 1925. There are several new varieties of cotton that are very promising which can be seen from this year's variety test. Some of these varieties have given promise for two or three years.

It appears that staple cotton can be grown on both valley and

hill land if the soil is good and properly fertilized. However, as a rule, it is better to grow shorter staple varieties of cotton in the hill section on the thinner land and longer staple varieties on valley or more fertile soils. The length of staple is governed by the fertility of the soil; the more fertile the soil, the longer staple any variety will grow.

COTTON SPACING TEST

The soil for the hill test was brown loam table land and for the valley test, fertile brown loam land. The plots on the hill land test were four rows each, duplicated, rows, 345x3½ feet. On valley land the plots were three rows each, duplicated, rows 196x3½ feet. Lone Star 65 cotton was used and was planted April 26 and 27.

An attempt was made to make the following spacing: Cotton as the planter left it, or unthinned, three stalks per foot, two stalks per foot, one stalk per foot, one stalk per 18 inches and one stalk per 24 inches.

Tables 5 and 6 give the actual space obtained.

TABLE 5—HILL SPACING TEST

Plants per foot	Yield of seed cotton pounds
4.02	1029.6
2.43	1020.6
1.75	915.5
1.20	904.7
.70	823.5
.63	764.0

TABLE 6—VALLEY SPACING TEST

Plants per foot	Yield of seed cotton pounds
5.03	1588.7
2.44	1781.3
1.70	1686.8
.89	1676.5
.66	1548.8
.57	1648.5

This season was unfavorable for the best development of cotton. About sixty-five per cent of a normal crop was made, due to too much rain in the spring and summer. The cotton hopper and boll weevil both did considerable damage. There is not the marked difference in spacing in either hill or the valley test that has been found in the past. On the hill land, the unthinned plots averaging 4 stalks per foot gave a little the best yield. And on the valley land 2.44 stalks per foot gave a little the best yeild. From these results our recommendations in the past have been about right. They are as follows: For hill land from 3 to 4 stalks per foot and for valley land from 2 to 3 stalks per foot.

COOPERATIVE FERTILIZER TEST

This work was conducted by the Holly Springs Branch Station in cooperation with county agents, agricultural high schools and farmers. Summer plantings were made on the station on both valley and

hill lands. The tests were made at New Albany on the farm of Mr. Dan Robins with the assistance of County Agent, W. C. Mims. The tests were made in Grenada County on the farm of Mr. O. D. Phillips, near Torrance, with the assistance of County Agent, Pollard. The plots at Ashland were on the school grounds and were conducted with the assistance of E. E. Deen, principal of the High School.

The valley test at the station was on improved valley land. Some wilt developed in this planting. The hill land test was on unimproved land, slightly rolling. The test at New Albany was on thin sandy loam, fairly level, and typical of the Pontotoc Ridge Section. The plots at Ashland were on slightly rolling table land, sandy loam of ordinary fertility. The plots near Torrance, Grenada County, were on level land, thin brown loam, heavily infested with wilt. Lone Star 65 was the variety used at New Albany and Torrance, and the hill test on the station. Mississippi Station Trice was used at Ashland and on the valley land test on the station.

Materials applied to the last three plots of all the tests, except at Ashland, supply as much plant food to the acre as would be supplied by 1,200, 1,800, and 2,400 pounds, respectively, of an 8-4-4 mixed fertilizer. All other treatments are based on 600 pounds of mixed fertilizer of the analysis indicated.

In all fertilizer work reported in this bulletin the increase was obtained according to the standard adopted by the American Society of Agronomy as reported in Vol. 16 No. 1 of the Journal . The column marked "check yield" was obtained according to the above method by assuming that there is a gradual increase or decrease in fertility from one check to the other. All plots were 1-20 acre in size, composed of four rows and in three series. Only the middle rows were used in computing yields.

TABLE 7—FERTILIZER TEST, VALLEY LAND—HOLLY SPRINGS

Pounds of material applied per acre				Pounds of seed cotton per acre			Dollars per acre		
Super-phos.	Nitrate of soda	Mur. of potash	Analysis	Plot yield	Check yield	Increase	Value of increase at 7c	Cost of fert.	Net gain
No fertilizer				873.1	873.1	——	——	——	——
300	160	100	8-4-8	1238.4	866.4	372.0	26.04	9.33	16.71
300	160	75	8-4-6	1125.1	859.7	265.4	18.58	8.73	9.85
300	160	50	8-4-4	1097.1	853.0	244.1	17.09	8.13	8.96
No fertilizer				846.5	846.5	——	——	——	——
300	160	25	8-4-2	1158.4	839.5	318.9	22.32	7.53	14.79
300	160		8-4-0	1101.1	832.5	268.6	18.80	6.93	11.87
300	320	50	8-8-4	1075.7	825.5	250.2	17.51	12.81	4.70
No fertilizer				818.5	818.5	——	——	——	——
300	240	50	8-6-4	1202.4	820.6	381.6	26.71	10.47	16.24
225	160	50	6-4-4	1107.7	823.1	284.6	19.92	7.57	12.35
150	160	50	4-4-4	1099.7	825.4	274.3	19.20	7.00	12.20
No fertilizer				827.8	827.8	——	——	——	——
600	320	100	8-4-4	1242.4	809.5	432.9	30.30	16.26	14.04
900	480	150	8-4-4	958.4	791.2	167.2	11.70	24.39	-12.69
1200	640	200	8-4-4	871.8	772.9	98.9	6.92	32.52	-25.60
No fertilizer				754.8	754.8	——	——	——	——

TABLE 8—FERTILIZER TEST, HILL LAND—HOLLY SPRINGS

Pounds of material applied per acre				Pounds of seed cotton per acre			Dollars per acre		
Super. phos.	Nitrate of soda	Mur. of potash	Analysis	Plot yield	Check yield	Increase	Value of increase at 7c.	Cost of fert.	Net gain
No fertilizer				568.4	568.4	——	——	——	——
300	160	100	8-4-8	1280.4	589.2	691.2	48.38	9.33	39.05
300	160	75	8-4-6	1282.5	610.0	672.5	47.08	8.73	38.35
300	160	50	8-4-4	1378.3	630.8	747.5	52.33	8.13	44.20
No fertilizer				651.7	651.7	——	——	——	——
300	160	25	8-4-2	1226.3	711.6	514.7	36.03	7.53	28.50
300	160	—	8-4-0	1384.5	771.5	613.0	42.91	6.93	35.98
300	320	50	8-8-4	1532.4	831.4	701.0	49.07	12.81	36.26
No fertilizer				891.1	891.1	——	——	——	——
300	240	50	8-6-4	1474.1	829.2	644.9	45.14	10.47	34.67
225	160	50	6-4-4	1417.8	767.3	650.5	45.54	7.57	37.97
150	160	50	4-4-4	1186.7	705.4	481.3	33.69	7.00	26.69
No fertilizer				643.3	643.3	——	——	——	——
600	320	100	8-4-4	1557.3	633.4	923.9	64.67	16.26	48.41
900	480	150	8-4-4	1661.4	623.5	1037.9	72.65	24.39	48.26
1200	640	200	8-4-4	1648.9	613.6	1035.3	72.47	32.52	39.95
No fertilizer				603.8	603.8	——	——	——	——

TABLE 9—COOPERATIVE FERTILIZER TEST—GRENADA CO

Pounds of material applied per acre				Pounds of seed cotton per acre			Dollars per acre		
Super-phos.	Nitrate of soda	Mur. of potash	Analysis	Plot yield	Check yield	Increase	Value of increase at 7c	Cost of fert.	Net gain
No fertilizer				594.5	594.5	——	——	——	——
300	160	100	8-4-8	1154.4	549.8	604.6	42.32	9.33	32.99
300	160	75	8-4-6	1025.1	505.1	520.0	36.40	8.73	27.67
300	160	50	8-4-4	901.1	460.4	440.7	30.85	8.13	22.72
No fertilizer				415.9	415.9	——	——	——	——
300	160	25	8-4-2	745.1	428.2	316.9	22.18	7.53	14.65
300	160	—	8-4-0	798.5	440.5	358.0	25.06	6.93	18.13
300	320	50	8-8-4	825.1	452,8	372.3	26.06	12.81	13.25
No fertilizer				465.2	465.2	——	——	——	——
300	240	50	8-6-4	927.8	446.9	480.9	33.66	10.47	23.19
225	160	50	6-4-4	850.5	428.6	421.9	29.53	7.57	21.96
150	160	50	4-4-4	802.5	410.3	392.2	27.45	7.00	20.45
No fertilizer				391.9	391.9	——	——	——	——
600	320	100	8-4-4	783.8	458.4	325.4	22.78	16.26	6.52
900	480	150	8-4-4	983.8	525.1	458.7	32.11	24.39	7.72
1200	640	200	8-4-4	1254.4	591.8	662.6	46.38	32.52	13.86
No fertilizer				658.5	658.5	——	——	——	——

TABLE 10—COOPERATIVE FERTILIZER TEST—NEW ALBANY

Pounds of material applied per acre				Pounds of seed cotton per acre			Dollars per acre		
Super-phos.	Nitrate of soda	Mur. of potash	Analysis	Plot yield	Check yield	Increase	Value of increase at 7c.	Cost of fert.	Net gain
No fertilizer				322.7	322.7	——	——	——	——
300	160	100	8-4-8	962.6	315.2	647.4	45.32	9.33	35.99
300	160	75	8-4-6	836.2	307.7	528.5	37.00	8.73	28.27
300	160	50	8-4-4	816.2	300.2	516.0	36.12	8.13	27.99
No fertilizer				292.8	292.8	——	——	——	——
300	160	25	8-4-2	662.1	287.6	374.5	26.22	7.53	18.69
300	160	—	8-4-0	664.3	282.3	382.0	26.74	6.93	19.81
300	320	50	8-8-4	937.1	227.0	660.1	46.21	12.81	33.40
No fertilizer				271.7	271.7	——	——	——	——
300	240	50	8-6-4	821.8	242.9	578.9	40.52	10.47	30.05
225	160	50	6-4-4	535.6	214.1	321.5	22.51	7.54	14.97
150	160	50	4-4-4	545.6	185.3	360.3	25.22	7.00	18.22
No fertilizer				156.4	156.4	——	——	——	——
600	320	100	8-4-4	735.3	158.3	577.0	40.39	16.26	24.13
900	480	150	8-4-4	848.4	160.2	688.2	48.17	24.39	23.78
1200	640	200	8-4-4	931.6	162.1	769.5	53.87	32.52	21.35
No fertilizer				164.1	164.1	——	——	——	——

TABLE 11—COOPERATIVE FERTILIZER TEST—ASHLAND

Pounds of material applied per acre				Pounds of seed cotton per acre			Dollars per acre		
Super-phos.	Nitrate of soda	Mur. of potash	Analysis	Plot yield	Check yield	Increase	Value of increse at 7c.	Cost of fert.	Net gain
No fertilizer				588.5	588.5	——	——	——	——
300	160	100	8-4-8	913.5	532.2	381.3	26.69	9.33	17.36
300	160	75	8-4-6	908.5	475.9	432.6	30.28	8.73	21.55
300	160	50	8-4-4	955.2	419.6	535.6	37.49	8.13	29.36
No fertilizer				363.4	363.4	——	——	——	——
300	160	25	8-4-2	625.1	350.1	275.0	19.25	7.53	11.72
300	160	—	8-4-0	575.1	336.8	238.3	16.68	6.93	9.75
300	320	50	8-8-4	721.8	323.5	398.3	27.88	12.81	15.07
No fertilizer				310.1	310.1	——	——	——	——
300	240	50	8-6-4	623.5	331.8	291.7	20.42	10.47	9.95
225	160	50	6-4-4	566.8	353.5	213.3	14.93	7.57	7.36
150	160	50	4-4-4	766.8	375.2	391.6	27.41	7.00	20.41
No fertilizer				396.7	396.7	——	——	——	——

In the several cooperative fertilizer tests given in the foregoing tables the following data is found:

The station valley test, which was planted the third time May 28, was the first field to become heavily infested with boll weevils. The yields of these plots were far below normal for the soil. On the plots where 600 pounds of 8-6-4 and 600 pounds of 8-4-8 were used the profits were a little above $16.00 per acre. (See Table 7). The heavy application was used at a considerable loss.

In Table 8, the station hill land test, planted April 28, 1,200 pounds of an 8-4-4 mixture gave $48.41 profit above the cost of fertil-

izer and 600 pounds of an 8-4-4 mixture gave a net gain of $44.20. This mixture appears to give the best results.

In Table 9, the Grenada County test, only the 600 pound applications were profitable. Where an 8-4-8 mixture was used the net gains were $32.99 per acre, 8-4-6 net gain $27.67 and 8-4-4 net gain $22.72 per acre. This land proved to be heavily infested with red rust. The indications are that on such lands fertilizers high in potash are advisable. These high potash plots were outstanding throughout the season.

In the New Albany test, Table 10, plots highest in potash content gave the best results and the yield decreased as the amount of potash was decreased. It also appears that the 600 pound application gave the best results.

In the plots at Ashland, Table 11, 600 pounds of an 8-4-4 mixture gave decidedly the best results.

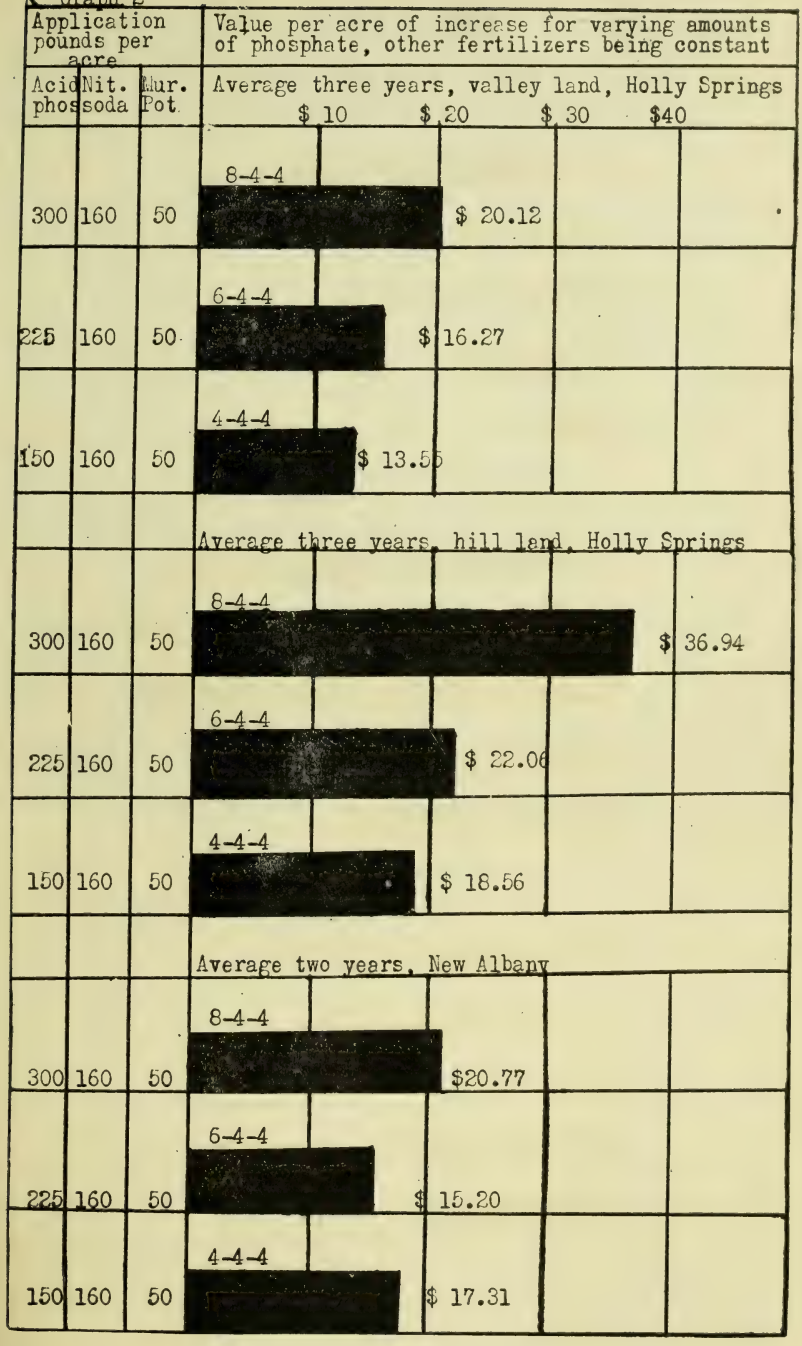
There is no marked difference in the fertilizer requirements in the several sections in which these results were obtained. It appears that phosphorus, nitrogen and potash in combination give the best results. It seems, in a majority of cases, that 600 pounds of fertilizer was the most economical quantity to use this year. Taking into consideration our past results at the station and at various points in North Mississippi, we find no marked difference in the soil requirements in this part of the state, except on land heavily infested with cotton red rust. The outstanding fact is that a complete fertilizer will increase the yield of cotton very materially, frequently doubling the yield per acre, as can be seen in the data given.

Graph 1

Application pounds per acre of increase for varying amts. Net value of potash, other fertilizers being constant.

Acid phos.	Nit. Soda	Mur. Pot.	Average three years, valley land, Holly Springs $10 $20 $30 $40
300	160	100	8-4-8 $24.50
300	160	75	8-4-6 $ 17.35
300	160	50	8-4-4 $ 20.12
300	160	25	8-4-2 $ 11.47
300	160	0	8-4-0 $ 5.20
			Average three years, Hill land, Holly Springs
300	160	100	8-4-8 $ 34.15
300	160	75	8-4-6 $ 37.55
300	160	50	8-4-4 $ 36.94
300	160	25	8-4-2 $ 23.00
300	160	0	8-4-0 $ 19.90
			Average two years, New Albany
300	160	100	8-4-8 $ 26.09
300	160	75	8-4-6 $ 21.87
300	160	50	8-4-4 $ 20.77
300	160	25	8-4-2 $ 15.63
300	160	0	8-4-0 $ 14.98

Graph 2


Application pounds per acre
Acid phos
Nit. soda
Mur. Pot
Value per acre of increase for varying amounts of phosphate, other fertilizers being constant
Average three years, valley land, Holly Springs
$ 10
$ 20
$ 30
$40
8-4-4
300 160 50
$ 20.12
6-4-4
225 160 50
$ 16.27
4-4-4
150 160 50
$ 13.55
Average three years, hill land, Holly Springs
8-4-4
300 160 50
$ 36.94
6-4-4
225 160 50
$ 22.06
4-4-4
150 160 50
$ 18.56
Average two years, New Albany
8-4-4
300 160 50
$20.77
6-4-4
225 160 50
$ 15.20
4-4-4
150 160 50
$ 17.31

Recommendations—The cotton farmers in this section should use a mixture of 200 pounds acid phosphate, 100 pounds of nitrate of soda and 25 pounds of muriate or sulphate of potash, or 100 pounds kainit. This mixture should be applied at the rate of from 400 to 600 pounds per acre. An 8-4-4 ready mixed fertilizer can be used instead of the home mixture, provided most of the nitrogen is from a readily soluble source.

From previous years reslts, it appears that as much as 1,000 pounds of a well balanced fertilizer will pay most years. Results also indicate that when the soil has been materially improved by the use of legumes and other practices, excellent yields can be obtained without an enormous investment in expensive fertilizers. When soils are very deficient in vegetable matter an 8-6-4 fertilizer instead of an 8-4-4 could be used to advantage. On land where rust effects the plants, an 8-4-6 or even an 8-4-8 fertilizer is advisable. Any form of potash may be used in making the mixture. Our practice is to apply all the fertilizer to be used on the land before planting.

POTASH SOURCES TEST

The soil used in this test is unimproved sandy loam, the same soil that was used in 1926. Each plot was fertilized the same as the year before. All plots were in triplicate.

Mississippi Station Trice was planted May 18.

Each potash carrier given in the table below was applied at such a rate as to supply 24 pounds of available potash per acre. All plots, including checks, received in addition to the potash, 300 pounds of superphosphate (acid phosphate) and 150 pounds of nitrate of soda per acre in order that deficiencies in these materials would not render the potash comparisons worthless. The column marked "check yield" was obtained by assuming that there is a gradual increase or decrease in fertility from one check to another, as is adopted by the American Society of Agronomy.

TABLE 12—POTASH SOURCES TEST—1927

Material applied	Pounds per acre	Pounds of seed cotton per acre			Percent of increase	Rank
		Plot yield	Check yield	Increase		
No potash		1067.7	1067.7	——	——	
Muriate of potash	50.0	1242.4	1041.5	200.9	19.29	2
Trona	41.7	1234.4	1015.3	219.1	21.58	1
No potash		989.1	989.1	——	——	
Sulphate of potash	50.0	1098.4	1000.6	97.8	9.77	3
Kainit	200.0	1087.7	1012.1	75.6	7.47	4
No potash		1023.7	1023.7	——	——	

NITROGEN SOURCES TEST

This test was conducted on unimproved sandy loam valley land. The plots were 1-20 acre each and on the same soil that was used in 1926. Each plot was fertilized the same as the year before. All plots were in triplicate.

Mississippi Station Trice was the variety used. Planting was

made May 18. Each nitrogen carrier given in the table below was applied at such a rate as to supply 30 pounds of available nitrogen per acre. The column marked "check yield" was obtained by assuming that there was a gradual increase or decrease in fertility from one check to another, as is adopted by the American Society of Agronomy.

TABLE 13—NITROGEN SOURCES TEST

Pounds of material applied per acre	Pounds of seed cotton per acre				
	Plot yield	Check yield	Increase	Percent increase	Rank
No nitrogen	361.2	361.2	——	——	
200 Nitrate of soda	775.8	383.2	392.6	102.4	3
150 Ammonium sulphate	806.5	405.2	401.3	99.0	4
115.5 Leunasalpeter	878.4	427.2	451.2	105.6	2
No nitrogen	449.2	449.2	——	——	
138.9 Calcium cyanamid	889.1	484.5	404.6	83.5	6
200 Lime nitrate	1023.7	519.8	503.9	96.9	5
65.2 Urea	1189.0	555.1	633.9	114.2	1
No nitrogen	590.5	590.5	——	——	

Note: All plots, including checks, received in addition to the nitrogen 400 pounds of super-phosphate (acid phosphate) and 67¾ pounds of muriate of potash per acre in order that deficiencies in these materials would not render the nitrogen comparisons worthless.

MIXED FERTILIZER TEST

TABLE 14—MIXED FERTILIZER TEST—1927

Pounds of material applied per cre	Yield seed cotton per acre
300 Super-phos. (Acid phos.) 160 Nitro-po	1019.7
300 Super-phos. (Acid phos.) 160 Nitrate of soda 31.2 80% Muriate	1027.8
32-16-16 127.5 32-16-16	889.5
300 Super-phos. (Acid phos.) 160 Nitrate of soda 50 Muriate of potash	908.5

The soil used in this test was slightly rolling table land, slightly uneven in fertility. All plots were triplicated. Lone Star 65 was the variety used and a second planting was made to secure a stand. This is the first year's results of this test and an unfavorable year for cotton.

SEED TREATMENT TESTS FOR SEED-BORNE DISEASE OF COTTON AND CORN

Tests were made in cooperation with the Department of Plant Pathology of the Experiment Station and the State Plant Board, the plan being furnished by Dr. D. C. Neal, Plant Pathologist, and Mr. H. H. Wedgworth, Associate Plant Pathologist, A. and M. College, Mississippi. These simple experiments were planned to determine the value of some of the organic mercury disinfectants for the control of corn root, stalk, and ear rots, also seed-borne diseases of cotton. Promising results have been obtained from the use of some of these compounds in the Corn Belt. The Du Pont Company and Bayer Chemical Company are putting on active sale campaigns of organic mercuries in this territory which makes it desirable to obtain some information on the value of these disinfectants for the control of certain seed-borne diseases under Mississippi conditions.

Corn Seed—Two series of plots were used in this test with corn. Each plot was composed of four rows each.

TABLE 15—CORN SEED TREATMENT

Treatment	Average yield per acre bushels
Not treated	43.1
Semesan	60.6
Bayer dust	64.0
Stimuline	63.3

Cotton Seed—Several organic mercury disinfectants were used for treating cotton seed. This test was conducted on improved valley land which was moderately infested with wilt. The seed treated with the various disinfectants were planted in three series and the outstanding ones are presented in Table 16.

TABLE 16—COTTON SEED TREATMENT

Treatment	Average yield per acre, pounds
Not treated	1259.9
Semesan	1583.9
Semesan, Jr.	1534.5
Special Bayer, 6x	1508.2

The data presented in Tables 15 and 16 are the results of only one season's work and we do not believe any great significance should be given to these figures. They indicate, however, the possibility of such disinfectants for the control of certain seed-borne diseases of corn and cotton under North Mississippi conditions. This work will probably be enlarged and continued for a number of years until some basic conclusion is reached.

CORN

The seasons were very unfavorable for corn in this section this year. At this station practically all corn is grown after vetch, or vetch and small grain, is harvested, except on lands used for experimental purposes.

As a rule early plantings of corn give the highest yields. When plantings are made earlier than the latter part of April in this latitude the results are often poor stands. On well drained fertile soils somewhat earlier plantings may be made. Our practice is to turn the land as soon as the cover crop is removed, disk and plant on level. If the seasons are dry a roller can be used to advantage after planting. One good rain to settle the soil almost insures a crop after a good stand is secured. Poor land is a poor place to plant corn, and on account of corn being a crop of low money value, only a small quantity of fertilizer can be used with profit. We have never been able to grow a profitable crop of corn on poor land, regardless of the methods used. Poor land could be planted to soybeans as a feed crop to better advantage than to corn.

Soybeans are planted in every row of corn grown on the station except in a few instances. Either of the following varieties can be used, according to the purpose for which they are grown: Laredo, Otootan, Mammoth Yellow and Biloxi. The last two named are fine for hogs. Soybeans will stand more water than corn. This being the case, unsafe wet lands can be planted to corn and soybeans, and if the corn is drowned out the beans will make a crop. One of the easiest ways to increase the fertility of a soil is to plant beans in every row of corn. Beans should be planted in every row of corn grown in the state. A dry year, the yield of corn will be reduced probably as much as 25% (See Corn and Bean Test, Table 18) but the two crops will more than equal corn grown alone. After the corn is harvested the beans may be hoed off or grazed with livestock. Our practice is to allow the beans to decay on the soil as a restorative crop. Where such a method is practiced, it only requires a few years to double the yield of corn grown on land. We have not found a cheaper method of soil building. It only requires about six pounds of Laredo beans to plant an acre with corn. In the absence of a combination corn and bean planter, a corn planter can be used to plant the beans on the same row planted to corn. A good method is to leave two hills of beans to one of corn. An average season the beans will almost cover the entire middles of the rows by harvest time. This should add from ten to twenty dollars worth of nitrogen to the soil and almost an equal amount in value of organic matter.

Planting—Corn should be planted very shallow on well prepared seed beds. There are but few crops that will make greater response to well prepared soils. Good preparation is half cultivation with corn. We prefer wasting seed corn in order to insure a good stand. On average land where a forty-two inch row is used, one stalk every thirty inches is a fair distance. As the land increases or decreases in fertility, the distance should vary. The more fertile the soil the more closely the corn can be grown; and the thinner the soil, the wider the distance

should be. No land should be planted to corn that does not produce more than 20 bushels per acre. It requires about 20 bushels per acre to pay the cost of cultivation, when rents and labor are considered.

Cultivation—When deep cultivation is practiced it should begin when the plants are small and should be kept up at frequent intervals. This method is more applicable for early plantings. For June planting, medium shallow cultivation is advisable. Four or five cultivations on late plantings are usually sufficient for good results. The cultivator should be run about the same depth at each cultivation, regardless of method used.

CORN VARIETY TEST

Plots, one row each, planted in checks and repeated seven times were planted June 10. The rows were three and one-half feet apart and 130 feet long. Two hundred pounds of a super-phosphate (acid phosphate) and 150 pounds of nitrate of soda was used.

TABLE 17—CORN VARIETY TEST

Variety	Yield in bushels per acre	Rank
Mosby, Station	54.0	5
Mosby, Delta	50.5	8
Mosby, D. & P. L.	53.7	6
Mosby, Lee	52.7	7
Mosby, Suttle	42.6	14
Cocke's Prolific, Station	54.6	4
Cocke's Prolific, Delta	46.6	13
Anderson's Choice	61.9	1
Hastings	58.1	3
Johnson's Prolific	49.0	10
Delta Prolific	48.6	11
Mexican June	40.3	15
Leguna	46.7	12
Paymaster, Neal	50.3	9
Paymaster, Fischer	59.8	2
Yellow Dent, Ferguson	33.3	18
Yellow Dent, Station	38.2	17
Large Golden Dent	39.9	16

The soil on which this test was conducted was highly improved but the seasons were unfavorable and the yields are much below a normal yield. Taking into account the corn variety test for the past six years, not including this year's test, the average yields were as follows: Neal's Paymaster 66.82 bushels; Hasting's Prolific, 65.16; Mosby, Station, 57.76; Cocke's Prolific, 58.67. Any of the above varieties are good. There are objections found by some farmers with Neal's Paymaster. The cobs are large and some seasons the tip ends of the ears are a little damaged. Mosby is one of the best all round varieties. As can be seen from the variety test, Anderson's Choice led the list this year. This is the first time we have introduced this variety into the test and it gives promise.

Fertilizer Recommendations—From past results a mixture of 150

to 200 pounds of super-phosphate (acid phosphate) and 100 pounds of nitrate of soda, or the same quantity of nitrogen in other readily soluable forms should be used. In our 1926 results, double the quantity of the above mixture gave the best results. Usually an application of 100 pounds of nitrate of soda gives an increase of 8 to 10 bushels of corn per acre. There is no question but that super-phosphate (acid phosphate) is necessary unless heavy applications were used on the soil in growing other crops so that the residual effect will be had. Side dressings of nitrate of soda are frequently very beneficial if they are not made too late. However, this is usually the case. The second application should be made when corn is about knee high, or a little later.

The following is the method used for growing corn on this station: Plant the corn on good land; use 300 pounds super-phosphate (acid phosphate) mixed with 200 pounds of nitrate of soda; apply under the seed; secure a good stand and cultivate shallow after each rain. Soybeans are planted with the corn. The average is rarely less than fifty bushels per acre, with an oat and vetch crop harvested from the land before the corn is planted.

Corn and Bean Test—This test was planted June 6 on valley land. Three hundred pounds of super-phosphate (acid phosphate) and 200 pounds of nitrate of soda were applied per acre.

TABLE 18—CORN AND BEAN TEST—1927

	1923	1925	1926	1927	Average
6 rows corn	48.2	45.7	57.9	46.1	49.5
6 rows corn with soybeans	45.5	37.3	51.5	43.4	44.4
6 rows corn with velvet beans	31.3	31.9	38.5	33.0	33.7
6 rows—two rows corn one row soybeans	42.5	37.5	43.1	28.0	37.8
6 rows—two rows corn one row velvet beans	40.2	34.2	46.6	24.3	36.3

Soybeans should be planted in corn, either in every row or in every third row. The two crops will more than equal corn alone. It is not advisable to plant velvet beans in every row of corn because in case of a wet year the corn will be greatly damaged by the beans. A good custom is to plant velvet beans in every third row of corn. During a wet season soybeans planted in every row of corn will damage the yield of corn but little. Therefore, it is recommended that soybeans be planted in every row.

SILAGE

Sorghum produces at least one-third more tonnage per acre on any kind of land than corn and has very nearly the same feeding value, ton for ton. Japanese and Texas Seeded Cane are both most excellent varieties. We have used the Japanese Seeded Cane almost exclusively for silage. Sorghum will stand a drowth better and will not damage if harvesting is delayed. This is not the case with corn. Corn blooms but once and if the weather is unfavorable during this period the results

will be poor. There is one thing to be guarded in sorghum: It must be mature to make a good grade of silage. Immature silage will make sour silage and sour silage is very undesirable cattle feed. If sorghum is planted with a small size eight-hole corn plate in the planter, the seed will be dropped in bunches about twelve inches apart and, with proper cultivation, hoeing may not be necessary. Sorghum grown thick in this way will produce small stalks which are more desirable for feed. This season two and one-half acres of Japanese cane produced at the rate of 27.2 tons of silage per acre. This sorghum was planted after a cutting of vetch was harvested from the land.

Sorghum Silage

Fertilizer Used—Eight hundred pounds of an 8-4-4 fertilizer was applied in the drill before planting. On good land fifteen tons per acre would be a good average. Ten tons of corn silage is a good average crop. When such heavy tonnage is removed from land a liberal amount of fertilizer should be used. The 27.2 tons of sorghum took out more fertility than the fertilizer used put into the soil. If a mixed silage of corn and sorghum is desired, plant in different plots of land and haul to the cutter in alternate loads. We have not been able to find a more suitable and profitable substitute feed for dairy cows.

SWEET POTATOES

The sweet potato is one crop that should be grown by every farmer and tenant on every farm in the South. It is adapted to almost any type of soil but probably does best on fertile sandy loam. An average crop per acre is about 200 bushels, while it is not at all uncommon to produce 350 bushels per acre. There is but little difference in food value between the sweet and Irish potato. The greatest drawback in sweet potato growing is disease. This can be controlled with proper care. Rotation of seed bed and fields used in growing potatoes and using clean seed will eliminate most of the trouble. The State Plant

Board is doing much good in fighting potato and other plant diseases that effect the economical wealth of the state.

Only clean, sound potatoes should be used for seed. Vine cuttings planted on land free from disease make desirable potatoes for growing plants. Sound potatoes taken from black rot infested potatoes can be used if soaked ten minutes in a solution composed of one ounce of bichloride of mercury to eight gallons of water. All potatoes should have this treatment, it matters not how clean they appear.

In making potato beds, convenience for watering should have much to do with the location. The beds should be on land where no potatoes have been grown within five years. If it becomes necessary to use the same beds each year, the soil should be removed and all parts of the bed disinfected with a solution of copper sulphate, one pound to twenty gallons of water. A wooden vessel should be used in making the solution.

The most satisfactory way to grow plants is in hot beds; it is the only safe way. The heat may be supplied from the use of stable manure, or artificially. When stable manure is used it is placed in a pit about 12 inches deep and about five feet wide and as long as desired. Horse manure is piled in these pits, about one wagon load to a pile. After two or three days this manure begins to heat; it is then spread out evenly over the pit and packed well and covered with about six inches of soil before the manure cools. In a few days this bed is ready to plant. No hot bed should be made until ready for use. This manure will furnish heat for about six weeks. The bed for best results should be covered either with hot bed sash or canvass to protect from cold rains. Bottom heat may be supplied from a furnace or some other method. A common method is to dig a trench about ten inches wide and twelve inches deep in the middle of the proposed bed. This trench should have a rise of not less than one foot every twenty-five feet of length. The lower end of the trench is widened out and deepened to be used as a furnace. Old tin or sheet iron is placed over the trench the entire length and six inches of soil put on the tin. The potatoes are bedded at the proper time. Clean sand or woods dirt is an excellent cover for potato beds. The potatoes are placed on the beds so as not to touch and are covered about two and one-half inches deep. A chimney is made of one by twelve plank, one inch thick and eight feet long. The advantage of artificial heat is that it can be supplied when necessary. Good potatoes can be grown on thin soil with a small application of a complete fertifizer.

Fertilizer Tests—The fertilizer tests with sweet potatoes the past year were not altogether satisfactory. Phosporus nor potash alone or in combination gave any appreciable results. Nitrogen was the limiting factor to some extent. Full results of the test will not be published. The seasons were good for the growing of sweet potatoes. The following table gives results of the test. All plots were in duplicate.

TABLE 19—SWEET POTATO FERTILIZER TEST—1927

Pounds of material applied per acre	Pounds of potatoes per acre	Dollars per acre		
		Increase @ 2c per pound	Cost of fertilizer	Net gain
No fertilizer	11930	——	——	——
400 Super-phosphate 200 Kainit	12090	6.00	4.93	1.07
400 Super-phosphate 200 Nitrate of soda 200 Kainit	13720	40.00	10.88	29.12
No fertilizer	11650	——	——	——
400 Super-phosphate 500 Cottonseed meal	13080	37.48	14.80	23.18
400 Super-phosphate 500 Cottonseed meal 200 Kainit	13080	37.48	14.30	23.18
400 Super-phosphate 100 Nitrate of soda 200 Kainit	13080	41.92	12.54	29.85
No fertilizer	10760	——	——	——

Fertilizer Recommendations—Until more definite information can be secured, 400 to 800 pounds of an 8-4-4 fertilizer will be recommended.

Spacing—Plants fourteen inches apart in the drill and rows three to three and one-half feet are the most economical distances we have found. The yield per acre can be materially increased by planting seven inches apart in the row.

Digging Potatoes—Remove the vines with a hay rake, or a vine cutter may used. In case of a killing frost before digging, the vines should be removed within two or three days. Two furrows with a double horse plow does good work in the absence of a potato digger. The greatest care should be used to prevent bruising. The potatoes should be assorted in the field and placed in baskets or boxes. This will facilitate hauling and curing in the curing houses. It is through bruised or cut potatoes that ring rot, storage rot and other diseases are introduced. Such potatoes should be disposed of as soon as possible after digging or stored separately.

Curing Potatoes—Get rid of excessive water in the potatoes soon after digging. If the weather is dry they will dry out rapidly in baskets if left in the field for a day or two. If stored in curing house and the weather is dry, open all ventilators, doors and windows and allow the air to circulate during the day, closing up at night. Keep fire going in furnace or stove during the day. It usually requires about two weeks to dry out a small house. The thermometer should range around eighty degrees during the day to secure the best results. Properly cured potatoes will stand four of five degrees below freezing without great damage. During extreme cold and wet weather a fire may be necessary. The proper temperature for keeping a house during winter is given at between forty-five and fifty-five degrees. If sweet potatoes are properly grown, and marketed when prices justify, the sweet potato

could easily be made one of North Mississippi's money crops. The demand is increasing in northern markets.

VETCH

Circular 74 on Vetch, issued September, 1927, is available.

Every land owner should be interested in maintaining soil fertility. After controlling surface water by terracing, the next step should be the growing of legumes, either summer or winter. Vetch, crimson clover, bur clover, lespedeza, soybeans, velvet beans, and cowpeas are all good legumes. Take your choice but grow legumes of some kind to keep up soil fertility. More profitable crops are grown following legumes without any additional costs. Legumes can be fed to work stock and dairy cattle. The method of this station is to grow legumes as a catch crop. In most instances the cost is but little more than seeding. If the legume is vetch it is only necessary to seed once.

The hope of southern agriculture is increased production with less cost on less acreage.

Vetch is easily started on land and if properly handled (allowed to seed once in two or three years) it will remain indefinitely on the land and come up as a volunteer crop each fall after crop cultivation has

Oats and Vetch. 3½ Tons Per Acre

ended. Vetch makes its principal growth in March, April and May; but little growth is made in the fall. Hairy vetch has given the best results here, although smooth or common vetch does well and matures about ten days earlier than hairy vetch. In order to make a good start on a farm it should be planted on fertile soil. It does not do well on wet soils or in wet seasons. Land on which barnyard manure has been scattered gives fine results.

Inoculation—For inoculating seed, use the following method: For each pound of seed inoculated use one-half pound of soil from land growing vetch successfully. Mix one-half pound of common glue in one

gallon of hot water. At planting time, moisten the seed with the glue water and mix with the vetch soil. Cover as soon as planted to prevent the sunlight from destroying the inoculation germs.

Vetch planting time is from September 1 to November 1. About the middle of September is considered our best planting time. Many failures with vetch are made on account of late planting. It is safer to plant the latter part of August than November 1. The seasons that follow control the success of the plantings. Plant in the middles of any well cultivated crop and cover with a cultivator of some kind.

The first crop should be turned under at maturity, which is usually around the first of June. After the first year a hay crop can be removed when some of the seed have matured. This hay has very near the same feeding value as alfalfa. The usual crop is from one and one-halt to two tons per acre. After the hay is removed, turn the land and plant to corn or some other crop.

Two Year Rotations—The following practice has been successful at this station: Plant fifteen pounds of vetch seed per acre in cotton middles, after inoculating the seed, about the middle of September. Cover with a cultivator. When the ground is moist the seed will properly germinate. Harvesting the cotton will damage the seeding but little. Allow the plants to mature, which will be about June 1. Turn under the first crop and plant to corn or some other crop. The following spring turn the land and plant to cotton. The following September the volunteer vetch will come up in the cotton middles. Allow this vetch to mature some seed after which harvest for hay. After harvesting the hay, turn the land and plant to corn as before. This method has worked well for the past sixteen or eighteen years. Lime at the rate of two tons per acre will aid the growth of vetch very much. Small grains can be introduced in volunteer vetch if done before the plants germinate in the fall.

Cut 3 shows oats and vetch harvesed at the rate of 3½ tons. The land used in this rotation has produced two bales of cotton per acre and this year 27.2 tons of sorghum silage after vetch was harvested. The supply of phosphorus and potash is kept up on this land.

LESPEDEZA

For three years in succession fertilizer and rate of seeding per acre experiments with lespedeza have not been conclusive. This plant adapts itself to the soil on which it is planted from the poorest to the richest, but like other plants, it does best on fertile soils. Lespedeza responds quickly, a normal season, to the use of phosphorus but is not benefitted by the use of lime, as is the case with most legumes. It appears to prefer sour to sweet soils. Many people have not fully realized what they have in this plant. Lespedeza is one of the greatest legumes ever grown in this country. It has been worth millions upon millions of dollars to the South in furnishing grazing, forage crops and restoring soils depleted of humus. Lespedeza should be planted on every idle acre of land in the South.

Preparation of Soil—But little preparation of seed bed is necessary. If the land is in rows it should be disked diagonally across the

rows and harrowed at right angles to the disking. Usually this is all that is necessary.

Small grain planting, either fall or spring plantings, furnish a good seed bed if the grain is harrowed with a section harrow just before the lespedeza seed are sown. After the grain is harvested the planting of lespedeza usually makes a good crop of hay by October. Seed are scattered by livestock and running water. A small quantity of seed can be sown on unbroken land as a result, within a year or two a perfect stand can be secured. It is not necessary to cover any planting by harrowing; it is better not to try to do so. If seeded upon freshly harrowed land the seed will not move during a rain, which will be the case on hard surface.

Time and Rate of Seeding—The time to seed lespedeza is from March 1 to the middle of April. There is some danger of frost killing the crop when planted too early on freshly broken and unprotected surface soils. The usual amount used for seeding an acre is one bushel (25 pounds.) Where as much as a bushel and one-half or even two bushels are used better results can be obtained. This is advisable when seed are cheap.

Variety Test—All plots for this test were in triplicate and planted on rolling table land of average fertility. The test was planted April 7 and harvested October 20.

TABLE 20—VARIETY TEST WITH LESPEDEZA

Variety	Pounds of barn dry hay per acre
Kobe 04479	5015.4
Common Lespedeza	3595.0
Korean 49027	2061.5

Harvesting Seed—The common method of harvesting seed is to attach a seed pan to a cutter bar of the mower. (These seed pans are on the market at about $12.50 each.) The seed pan catches the seed that shatters out as the hay passes over the top of the pan. The best results are usually obtained immediately following a frost in the fall and on land where the plants are small. Thin land usually furnishes more seed than fertile soil. This pan is used in hay harvesting as the best seed are secured in this way. Seven bushels of seed are about an average saving per acre. The seed sell from $2.00 to $6.00 per bushel, according to supply and demand.

For mid-summer grazing in pastures there are but few plants that could take the place of lespedeza. It should be in every pasture in the South as one of the main legumes. It grows nicely with other plants.

SOYBEANS

The soybean should occupy first place as a forage crop for the hill section of the state. Laredo, Otootan, Biloxi and Mammoth Yellow are considered four of the best varieties and especially adapted to southern agriculture. Otootan and Biloxi are both late maturing varieties and should be planted early for best results. Either of the four

varieties makes a most excellent quality of forage and grain combined. When grain for hogs is desired the Mammoth Yellow and Biloxi should be used. There are many varieties of soybeans on the market and all have their place for the various conditions over the United States. On account of the weather and other conditions this year, it was almost impossible to make an early planting of beans.

Planting Time—Any time from the middle of April until about the middle of July is a fit time for planting this crop. On this type of soil it is not advisable to attempt to grow soybeans broadcast. As a usual thing, our soils are too thin for the best results when using this method.

Eight or ten pounds of Laredo, Otootan or Virginia beans will seed an acre. About double this quantity of Mommoth Yellow and Biloxi is required as the seed are much larger.

Soybeans will grow on land too wet to grow good corn. Much of the wet land should be planted to corn and soybeans and if the corn is drowned out the soybeans will make a good crop. Most of the hay grown on the farm is soybeans planted after early spring crops.

Soybeans are planted in every row of corn not used for experimental purposes on the station farm, and on land after oats and vetch are harvested. The land is broken broadcast and disked and the bean seed drilled in rows about thirty inches apart. Two cultivations are usually sufficient to insure a good yield. Three or four hundred pounds of an 8-4-4 fertilizer per acre gives the soybeans a wonderful help in producing a good crop. An application of 200 pounds of acid phosphate and 100 pounds of kainit per acre will pay well. Soybeans respond wonderfully to the use of a small quantity of lime.

Inoculation—Inoculation is of greatest importance. Many plantings prove a failure for the lack of proper inoculation. Land on which a small quantity of stable manure has been broadcast gives good results when the seed are inoculated. Use about one-half pound of soil from a well inoculated field, to each pound of seed, using the glue method explained under vetch.

A variety test was planted June 29 and only a fair stand was secured. All plantings were in triplicate.

TABLE 21—VARIETY TEST WITH SOYBEANS

Variety	Pounds of hay per acre
Laredo	4691.6
Virginia	2895.1
Otootan	6678.1
Mammoth Yellom	3942.9
Biloxi	4286.5

The planting was too late to secure a yield of seed. Any of the above varieties could be expected to yeild from fifteen to thirty bushels per acre, according to conditions.

SORGHUM AND SAGRAIN TEST

This test was planted on improved brown loam table land June 15. The plots were one row each and repeated twice.

This planting was near the barns and the sparrows did considerable damage to the grain.

TABLE 22—SORGHUM AND SAGRAIN VARIETY TEST

Variety	Pounds of green corn	Pounds of grain per acre
Red Amber sorghum	27007.8	925.9
Honey sorghum	46983.7	1640.7
Goose Neck sorghum	45988.0	1760.0
Black Hull Kaffir	29497.0	889.6
Pink Kaffir	19975.8	1198.5
Double Dwf. Milo 1982	22029.4	991.3
Preno Dwf. White Milo	22962.9	797.6
Double Dwf. Maise	12321.5	807.2
Hegari	17735.5	769.2
Darso Bred-up	28771.8	2593.2
Sagrain 576	29559.3	4354.0
Sagrain 303-437	30306.0	4014.5
Sagrain 309	33853.1	2617.9
Schrock Kaffir	23958.6	2836.5
Spurr Feterita	14810.7	784.0
Japanese Ribbon	52771.0	1126.5

ALFALFA

A fertilizer test with alfalfa was planted early in the spring. The soil used was brown loam table land of average fertility. The continued rains destroyed two spring plantings of seed. In September the twenty-seven plots were prepared and planted with good success. On December 20 the seeding was very promising. Our results in the past have indicated that the proper time to seed land to alfalfa is around the middle of September. The land should be prepared and seeded as soon as practicable after a rain without disturbing the soil except to cover the seed with a harrow.

BEETS

A comparatively small area was set aside at the station for testing beets as a stock feed to ascertain if they will grow in this climate and what tonnage could be expected. On average soil a very poor stand was secured and the continued spring rains made the crop expensive to cultivate. There is no question but that a heavy tonnage of beets can be grown per acre. Much care should be used in seeding the land, also in securing a fresh supply of seed. Two varieties were used in the test with the following results:

Mangel Wurzel produced ----------18,640 pounds per acre
Sugar Beet produced ----------17,769 pounds per acre

These beets have been covered with straw under a shed to be fed to cattle this winter. In using for feed the beets are chopped in pieces and fed in place of silage. Where a dairy is too small to justify a silo beets could be grown and used in place of silage to advantage.

DAIRYING

A registered herd of Jersey cattle is owned by the station. From the time this station was established it was recognized that dairying and poultry would be necessary to furnish a market on the farm for legumes and other crops grown, and to utilize the idle lands for grazing. North Mississippi will never come into her own until dairying, poultry, cotton and feed growing become her chief industries. In the past the dairy has been run so as not to interfere with regular station work, leaving the experimental feature to the College herd at the A. and M. College of Mississippi. Most of the milk secured is sold locally at the dairy barn and the balance is separated and the cream shipped on the butter fat basis. The skimmed milk is fed to calves and poultry. This method interferes but little with regular station work.

Several projects are in progress to ascertain the value of manure measured in pounds of cotton, or other crops, also a system of rotation including forage crops suited for dairy feeds, etc. These results will be reported later.

The dairy possibilities in this section are good. Cream and milk markets are close in almost any direction, with good roads in practically every county. There are thousands of acres of idle lands that could be used in growing feed and making pastures. Good cows can be had in many sections, but the price is rapidly increasing with the increased demand. Cream separators can be had at almost one's own terms.

How to Begin Dairying—The following is a suggested way to begin dairying: Get together a few cows, the best available; purchase a separator if necessary and start milking. Breed these cows to a first class bull of a dairy type, and in a few years you will have a herd of cattle. Sell off the poorest producers as fast as possible and replace with good cows. Keep daily records of every cow to determine her value. Four or five real good cows will pay a greater profit than ten or fifteen ordinary milk cows. It is hard to pay too much for a real good (second or third calf) dairy cow. She should pay her purchase price the first year and be ready to serve her master the rest of her life if she is properly handled and fed. There is idle labor on the farm half the year that has to be fed all the year. The South has advantages in her favor in the mild winters, cheap lands, cheap labor and long growing seasons. Inexpensive barns can be used. We will succeed when we become "Dairy Minded" and not until then. Dairying should interfere with the growing of cotton but little, in fact in a few more years, more cotton should be grown.

Pastures—Good pastures are almost as essential to successful dairying as good cows. The land should be prepared by cutting the bushes and unnecessary trees, terracing to control soil washing, and breaking with a plow and seeded with bermuda grass, lespedeza, white clover, hop clover, paspalum and carpet grass.

If the land is poor, better results can be obtained by sodding the bermuda grass. If bermuda grass seed are to be sown with other grasses, probably the best date is around April 1 White clover and carpet grass can be sown in the fall or early spring on top of the sod

and secure a fair degree of success. One of the station pastures has properly supported one cow per acre for the past five years.

The pasture should be made before purchasing the cows.

Forage Crops—Dairying and purchasing feed is like growing cotton and buying feed for labor and work stock—it cannot be done successful under average conditions. The best forage crops for this section are soybeans, sorghum, Sudan grass, lespedeza and cowpeas. One acre per cow where good land is used is recommended for growing forage. All of the forage and feed should be grown on the farm with probably the exception of some of the grain.

Fifteen bushels of corn per cow is the usual allowance. This corn would give the best results if ground into corn and cob meal. Cotton seed can usually be exchanged, pound for pound, at oil mills for cotton seed meal. This exchange is very desirable for both the mill men and the grower. The meal has more than duoble feeding value. There is no better nor cheaper proteid feed on the market than cottonseed meal, as far as it can be used. Probably more cow trouble comes from feeding an excessive amount of cottonseed meal to dairy cattle than from any other source. With good pastures, silage, legumenous hays, corn and cottonseed meal produced on the farm, it will not be necessary to purchase more than a little wheat bran or ground oats to make as good a feed as can be purchased on the market.

Dairying does not mean less cotton, but more fertile soil on which to grow larger crops. The station has used a milking machine for the past seven years with satisfactory results. One man maintains a twenty-cow dairy and keeps a sanitary barn. With average farm labor, a milking machine is hardly necessary.

Mr. Otis B. Casanova and Mr. O. K. Morgan have assisted very materially in the success of the year's work. Mr. Leo Bate took charge of the dairy in December in place of Mr. C. M. Anderson, who resigned.

Thanks are extended to Director J. R. Ricks for the kind and pleasant way in which he has directed the work.

BULLETIN NO. 254 AUGUST 1928

A NUTRITION INVESTIGATION OF NEGRO TENANTS IN THE YAZOO MISSISSIPPI DELTA

BY
DOROTHY DICKINS

Mississippi Agricultural Experiment Station
A. & M. COLLEGE, MISSISSIPPI
J. R. RICKS, DIRECTOR

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A NUTRITION INVESTIGATION OF NEGRO TENANTS IN THE YAZOO-MISSISSIPPI DELTA

BY DOROTHY DICKINS

INTRODUCTION

The question of food consumption is receiving more attention today than ever before. This is, of course, due to the fact that each year brings more evidence of the very close relation of food to health. In Mississippi negroes make up about 58 per cent of the farm population. Therefore, a knowledge of the amount, kind, and quality of food consumed by these people is of vital importance.

Since the question of food consumption is so closely allied to that of health, in it, perhaps, lies one explanation at least, for the high death rate and lack of endurance found among negroes.

Popular ideas about the diet of the negro are usually made up of a combination of fact and fancy. Only by accurate observations and studies of food actually used in typical homes is it possible to say whether or not a people are adequately fed. From time to time such studies have been conducted among whites. Very few have been conducted among negroes. In fact, it is impossible to find an account of any recent food consumption studies made among them.

Among the few studies which have been conducted are those of Dr. W. O. Atwater. Descriptions found in his Alabama study would apply as far as a few points are concerned to negroes of to-day. However, such statements as, "In the country practically all negroes live in cabins, generally built of logs, with only one or at the most two rooms. Cooking is nearly always done over the open fire. Only two of the families visited had stoves," do not picture conditions as they now exist. In fact, many changes have been made since the Atwater studies.

A general improvement in diet is not the least of these changes. The negroes of today certainly have more to eat than the combination of salt pork, cornmeal, and molasses described by Atwater in his Alabama study.

In the light of these facts, it seems that a knowledge of dietary conditions as they now exist among negroes of Mississippi is needed. Such was the objective of the project which is discussed in this bulletin.

1| Miss Ernestine Frazier, an assistant in the department, made the calculations in this study.

DESCRIPTION

OF AREA SELECTED

In the area, known as the Yazoo-Mississippi Delta, the negro constitutes about 85 per cent of the farm population. For this reason, it is often called the "black belt" of Mississippi.

The Yazoo-Mississippi Delta is a strip of territory about one hundred and fifty miles in length. Its entire western border is washed by the Mississippi river and most of its eastern border by the Yazoo river. Nine counties lie wholly within its area.

One has well written that, "Nature knows not how to compound a richer soil. It can no more lie idle than the sea can keep still. Every square foot of it riots in vegetable life."

The plantations in this section vary from a few hundred acres to several thousand. On some of these the proportion of negroes to whites runs as high as 100 to 1. The great staple crop of this area is cotton. In the cultivation of cotton the Delta has nearly every system of land tenure to be found in the South, though cropper labor is most common.

Fig. 1.—The Delta produces cotton in such abundance that a tenant with only a few acres of land must have the help of his entire family in gathering the crop.

In the usual agreement, the cropper furnishes his labor in planting, cultivating, and gathering the crop; the land owner furnishes the

land, the team, the implements, and the seed. The cost of the fertilizer is shared equally. The planter advances to the cropper such supplies or cash as are needed during the year, to be paid for out of the latter's half of the crop.

OF SUPERVISORS SELECTED

Four typical counties, Bolivar, Coahoma, Quitman, and Sharkey, were selected. Two intelligent negro women in each of these four counties were employed to supervise the food consumption studies. These studies were then located on the plantation on which these women lived. Emphasis was placed on the selection of the supervisor, for in her hands largely rests the success or failure of a study of this nature.

This method not only gave good supervisors but as varied types of plantations, as far as size, methods of operation, and settlement are concerned, as could be obtained.

OF METHODS USED IN ENROLLING FAMILIES

Before taking any steps to enroll families the plans and purposes of the study were explained to the planter who in no case objected to a study taking place on his plantation.

Instead of the usual house to house canvass used in enrolling white families, the newly appointed supervisor was asked to call together all the housewives living on the plantation. At this meeting the purpose of the study was explained.

The study was presented to this group in the form of a health project. It was approached from two angles: (1) the needs and benefits of such a study, and (2) what was expected of the families who enroll.

Through a talk built around these two points and based on negro psychology, it was possible to create a desire to enroll in the minds of every housewife present. Only those families who had at least one member who could read and write were enrolled. This was not necessarily the housewife. In some cases it was the husband, in other cases a fifteen year old boy or a married daughter.

Only ten families were enrolled on each plantation. This number was about all one woman could carefully supervise.

Eight food consumption studies located on two plantations in each of four counties, including eighty typical negro families, were started in February of 1927. This time was thought to be best as it came after the cotton picking season and at the beginning of the cultivating season. A study of one month's duration was planned rather than four shorter periods distributed throughout the year. The transitory habits of negro tenants would make a study distributed throughout the year very impracticable.

OF FAMILIES SELECTED

There are two busy seasons on the Delta plantation, the time of planting and cultivating the cotton, which begins in March and ends in July, and cotton picking time which begins in August and usually ends in November. Men and women, old and young, even the little

children, are pressed into work during these rush seasons. The rest of the time is largely devoted to visiting, social life, revivals, or even absolute idleness. A negro home demonstration agent writes, "there are two classes of rural women, one an idle set who fish and visit neighbors; another, a thrifty set who piece quilts, sew, and improve their homes."

Even during rush seasons the women manage to get to town about once a month. The men usually go more often. In every Delta town there are a number of stores that cater to this trade, that sell everything from fried fish sandwiches and bottled drinks to blue jean shirts.

Fig. 2.—A well constructed and neatly kept home of the two-room type.

COMPOSITION

Table 1—Comparison of size of negro families enrolled in this study with white families in a similar study. 1|

Size of Families	Number of Families		Number of Members included in these families	
Number	Negro	White	Negro	White
2	15	0	30	0
3	17	20	51	60
4	18	17	72	68
5	10	20	50	100
6	5	19	30	114
7	7	15	49	105
8	2	5	16	40
9	1	1	9	9
10	3	2	30	20
11	1	0	11	0
12	1	1	12	12
Totals	80	100	360	528

1| Data from this study is to be compared throughout the bulletin with data obtained from a similar study conducted in 1926 among white people living in the Brown Loam and Short Leaf Pine areas of Mississippi [9]. The terms negro and white although not strictly comparable will be used. This is the usual terminology observed in the South.

White families were on the whole, larger than negro families. Higher death rate among negroes would partly account for this difference. The average negro family was composed of 4.5 members. This corresponds closely with average found by Kirkpatrick [30] that of 4.7 members.

Table 1 includes parents, sons, and daughters who were at home. The dietary studies also include twenty-six relatives sheltered in these homes. Twelve of this number were orphaned children or children with only one parent. The majority of negro homemakers will usually find a place for another child, will accept him, and treat him as one of their own.

This makes a total of 386 people included in the study.

Table 2.—Ages of husbands, wives, and children.

Age Group	Husbands	Wives	Children
Years	Number	Number	Number
under 5	—	—	42
5-9	—	—	55
10-14	—	—	50
15-19	—	3	53
20-29	10	22	10
30-39	20	28	—
40-49	22	20	—
50-59	12	6	—
60-69	6	1	—

There were more children in the 5-9 year group. This was the case in the study of whites. More wives were 40 years of age and over in the study among white people than in the study among negroes. This is perhaps due to early marriage among negroes. Colored girls usually marry before the age of twenty years. Ten of the eighty homes studied had no husband. In some cases he was dead, in others he had deserted his family.

FINANCIAL STATUS AND LIVING CONDITIONS

THE HOME

On the Delta plantation the one-room cabin is not in evidence. It disappeared many years ago. Where it once stood, rests a house containing, usually three rooms, two bedrooms and a kitchen. A number of homes are painted, but the majority are white-washed. Practically every home has a few flowers, though often only castor plants or sunflowers. In the competition for labor, the laborer's homes are being constantly improved.

Fig. 3—A glimpse into the bedroom of a negro farmer's home. The phonograph is often found here for negroes are music lovers as well as musical.

As to the interior, one of the negro home demonstration agents writes, "The average home has only the furniture they cannot do without, such as beds, chairs (usually not more than four), possibly a dresser and wash-stand, more often a dresser than a wash-stand. It is a rare case to find books. Few take a monthly paper. Most of the houses are papered with newspapers which are bought by solicit. Magazines are used for pictures only. Many of these are pasted on the walls of the homes. The women have learned through club work to make inexpensive rugs from discarded stockings and clothing. Aside from these, there are no rugs. Nine out of every ten have no window shades. All have some kind of curtains."

The food is prepared and eaten in the kitchen. Here one generally finds a stove, a table, a few chairs, and several shelves on which dishes and utensils are kept. A number of homes under the influence of extension workers have home-made kitchen cabinets. Three meals: breakfast, dinner, and supper are served during work seasons. At other times only two meals, breakfast and dinner are served in the majority of homes.

On the whole, the average negro does not keep his home as clean as the average white person. One of the negro home demonstration agents states, "about two-thirds of our people keep their homes as clean as they know how to." Of course, many have low standards of

cleanliness. In making any statements, one should take into consideration the poor facilities for keeping clean in the average negro home. Running water and sewerage connections are unknown luxuries.

THE TENANT SYSTEM

Before the late war, every planter had his commissary from which certain staple supplies were issued at stated intervals. Money was earned to purchase articles not carried by the commissary by doing odd jobs for some white man or through sale of home raised products and wild fruits and nuts.

Right after the late war, there was a general exodus to the northern states. In order to hold old labor and get new labor many changes were made in pre-war methods of management. The old commissary system as formerly operated was entirely done away with. Many advanced cash altogether. A number made little changes in their commissary but advanced some cash for purchasing articles not handled by the commissary. Others continued their commissary as formerly operated but added additional supplies to their stock. Three plantations included in this study operate on the first plan, one on the second, and four on the third.

If the negro makes more than his expenses, it is generally spent by February. Therefore, February finds him without money or help from the landlord, for supplies or cash are usually cut off between working seasons 1|. Supplies or their equivalent in cash are issued March 1, which generally begins the working season. Therefore, the food studies conducted partly in February and partly in March, show conditions as they exist during both periods.

Table 3.—Acreage operated, production of cotton and corn, value of home raised products sold, and gross income—averages per family.

Plantation Number	Acreage Operated	Cotton Produced	Corn Produced	Value of Products Sold	Gross Income
	Acres	Bales	Bushels	Dollars	Dollars
1	23.37	18.4	147.6	$7.60	$845.61
2	23.90	9.7	42.0	$6.70	$431.16
3	13.30	9.0	13.5	$ .50	$458.10
4	21.90	13.3	58.7	$2.80	$587.96
52|	27.90	17.6	148.0	$5.00	$828.18
6	28.45	12.0	187.5	0	$582.37
7	26.90	9.8	140.5	$30.89	$518.24
8	26.80	7.9	117.5	$4.10	$382.11
Average All Families	24.06	12.21	106.91	$7.20	$579.21

The income figures were obtained by taking half of the value of the previous year's crop after one half of the cost of the fertilizer had been deducted. This method, of course, gives more or less approximate

2| Two renters included on this plantation.

1| There are a few planters who do not stop advancing supplies the year around but carry all credits and charges on the books until the date of settlement at the end of the year.

figures, for in many cases extra money was earned by day labor; in a few cases money was deducted to pay for additional help during rush seasons. Yet, these figures probably serve their purpose, that of giving a fairly accurate picture of the financial status of eighty negro families: 78 croppers and 2 renters.

One may then sum up the financial status of the average negro family as a family of four, with a home, twenty-four acres of land, the privilege of raising a large part of their food stuff on this farm, fuel to be had for the cutting, and around fifty dollars a month from sale of crops. From this fifty dollars interest on money or supplies advanced and a half of the marketing expense of the crop must be paid. That this condition is not better is usually attributed to two facts: (1) the negro as a rule is not an efficient farmer, (2) he does not remain long enough in one place "to gather moss."

OF TIME SELECTED

This study was conducted in February and March for these months would (1) show diets of negroes when they were being supplied as well as when supplies were cut off, (2) would bring out the typical winter diet as well as the early spring diet.

A few of the families had gardens at the time of the study, for February and March were unusually warm. Fortunately, the study was over before the Mississippi levee broke, for five of the eight plantations were either flooded or surrounded by water.

At this transition period, from one season to another, one should get a fairly good picture of average dietary conditions.

METHODS

FOR CONDUCTING STUDY

The supervisor visited the housewife, placed a pair of hanging spring scales in her kitchen, and weighed all foods on hand, both solids and liquids. She, then, recorded food with quantity on Inventory Blank.

The housewife or person who had agreed to keep the records was given a note book with pencil attached for keeping a daily record of additions made to the food supply for a period of one month. Each page of the note book contained the following blank form to be filled out:-

FIG. 4—DAILY RECORD

	Amount	Cost	Date
Cornmeal			February 4—Friday
Flour			
Rice			
Cane syrup (kind)			
Corn syrup			**Visitors**
Sugar			Sex Age No. Meals
Butter			
Lard			
Chicken			
Fish			
Salt pork			**Meals From Home**
Fresh pork			Sex Age No. Meals
Sausage			
Eggs			
Cheese			**Good food fed to ani-**
Whole Milk			**mals sold or given**
Butter Milk			**away**
Cabbage			Food Quantity
Collards			
Mustard greens			
Dry Peas			
Irish Potatoes			
Sweet Potatoes			
Canned Tomatoes			
Turnip greens			

Other foods:-

Name	Quantity	Cost

1. Usually termed, "Waste of Edible Food."

On her daily visits to the family, the supervisor checked over these note books and copied contents to the "Daily Food Record" and "Meals Served" blanks. The note book was used because: (1) one note book seemed less formidable than a stack of blanks, (2) there was less danger of a note book being misplaced.

During the third week of the study a record of menus served was kept. At the end of the study, the supervisor took another inventory. At this time, she filled out the "Family Record" and "General Information" (as to number of hens, cows, etc.) forms.

This simplified method of record keeping and the daily visits of the supervisors were probably the two factors that made possible such a study. The fact that all families enrolled in this study completed it, shows the interest felt.

FOR CALCULATING ENERGY AND NUTRITIVE VALUES

The long method based on Sherman figures [56] was used for calculating the energy and nutritive values of dietaries. The value of cooked foods was obtained by preparing with methods most generally used by the Delta negro and then calculating value of a pound of the cooked products. In figuring the records, 10 per cent was deducted for plate scraps.

Â double scale [19] was used in estimating the food requirements of each family. In this scale provision is made for the relatively greater need for protein and mineral of the growing child.

Table 4.—Double scale 1| for calculating the energy, the protein, and the mineral needs of a family 2 |.

Age of Ind. Years	Degree Of Activity	Energy scale 3|		Protein and Mineral Scale 4|	
		Male	Female	Male	Female
Over 60	Active 5|	1.0	.7	1.0	.7
18-60	Active	1.2	1.0	1.1	1.0
15-18	mod. active	1.2	.9	1.6	1.2
11-14	mod. active	.9	.9	1.2	1.2
6-10	mod. active	.7	.7	.9	.9
Under 6	mod. active	.4	.4	.6	.6

1. This scale has been changed since this bulletin was written. See [22].

2|. The standard is based on the energy, protein, and mineral requirements of a moderately active man weighing 150 pounds.

3|. 1.0 equals 3,000 calories.

4|. 1.0 equals 75 grams protein; 0.69 grams calcium; 1.3 grams phosphorus; and 0.015 grams of iron.

5|. Female over 60 counted as moderately active.

By the use of the double scale it was found that the average family's energy need was equivalent to 4.319 adult male units, and its protein and mineral need to that of 4.712 adult male units. The persons included in this calculation differ somewhat from those included in the number per average family.

FOR VALUING FOOD

A record of the cost of all foods purchased was kept. Home raised products were priced at average retail selling cost found in the stores of the nearest town where these families shopped. For those foods not offered for sale by these stores, the average selling cost found in mail order catalogues was used 1|. This method was used as it gave a good basis for comparison of the value of foods purchased with those furnished by the farm.

No record was kept of those products without food value, such as salt, coffee, tea, soda, flavoring, etc. Thus, the cost figures per man per day obtained for this study are slightly lower than is actually the case.

RESULTS

Records of food consumption for one month were obtained from eighty families, as was planned.

ENERGY AND NUTRITIVE VALUE OF DIETARIES

Table 5.—Value of the average diet in food consumption studies conducted among negro and white families in terms of energy, protein, calcium, phosphorus, and iron compared with a standard of optimum requirements.

Study	Energy per Man per Day									
	Energy		Protein		Calcium		Phosphorus		Iron	
	Calories	% of Standard	Grams	% of Standard	Grams	% of Standard	Grams	% of Standard	Grams	% of Stand.
Standard	3000	100	75	100	0.69	100	1.3	100	.015	100
Negro Study (80 records)	2863	95	64	85	0.53	77	0.98	75	.122	81
White Study (75 records)	3223	107	79	105	1.12	162	1.35	104	.124	83

1|. This was only resorted to in case of two or three foods, for the small variety of food raised by the negroes was generally carried by the stores of the nearest town.

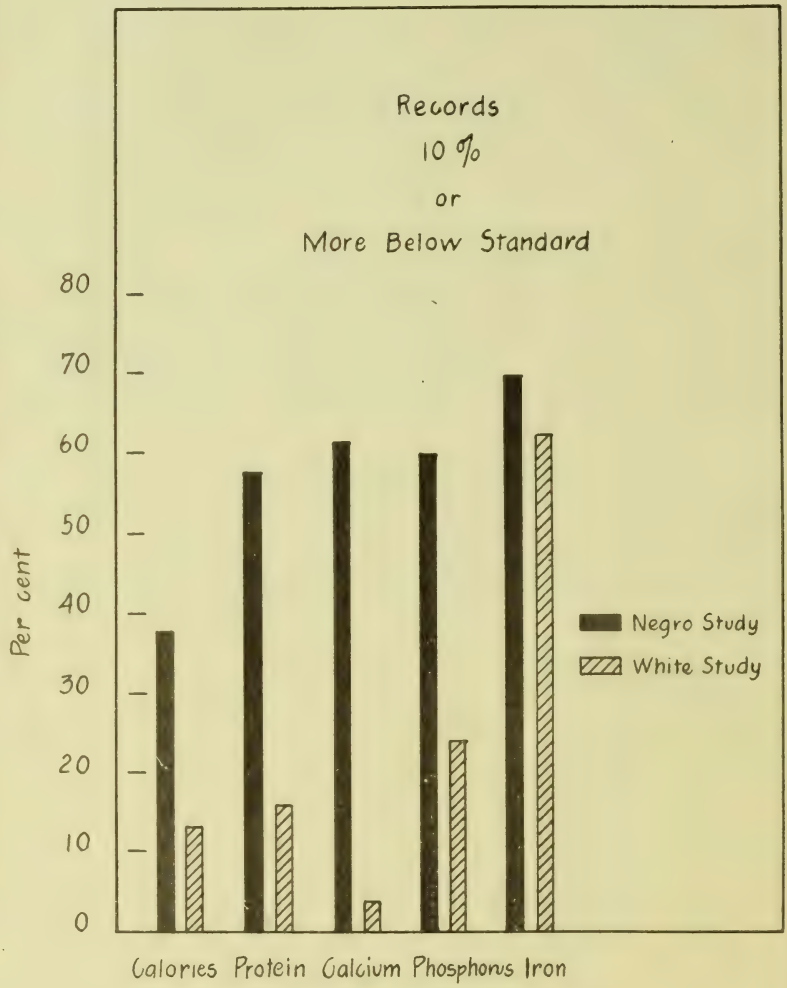

Fig. 5.—Percent of the total number of records from negro and white families which were 10 per cent or more below standard in energy, in protein, in calcium, in phosphorus, and in iron.

The dietaries of negro tenants in the Yazoo-Mississippi Delta were much lower in energy value and in the 4 nutritive factors than those of white people from the Brown Loam and Short Leaf Pine Areas of Mississippi. This was especially true in respect to calcium.

How can the marked difference in dietaries of these two groups be accounted for? Money value of food consumed amounted to fifteen cents more per man per day for the whites. 74 per cent of the food in the white dietaries came from the farm, whereas only 44 per cent of the food in the negro dietaries came from the farm. This means that the negro spent more in actual cash for food than did the white man. Thus, the poor diet of the negro does not seem to be altogether due to lack of supplies or cash for purchasing food. An explanation for this difference seems to lie, rather, in the fact that the white man raises more food on the farm. This means that if the negro had raised as much food as the white man, and if he had used the same amount in cash for supplementing this food supply, that he would have been as well if not better fed than the white man.

The majority of negroes plant, at least, three or four vegetables during the year. However, few produce even half of the needed supply. Many planters state that they have had the gardens of their tenants moved into the field because: (1) a garden in the field is more likely to be worked, (2) a garden spot around the house calls for a fence which is soon torn down to supply wood for the family. A partly torn down fence gives a neglected air to the otherwise carefully laid out plantation. On the other hand, a number of negroes claim that planters discourage the planting of a garden, for they desire this land for raising cotton.

These two explanations are also offered for the small number of milk cows owned by Delta negroes. Perhaps both groups are right. In some cases the small amount of food raised on the farm is doubtless due to negligence of the negro, in other cases, it is doubtless due to lack of vision on part of the planter.

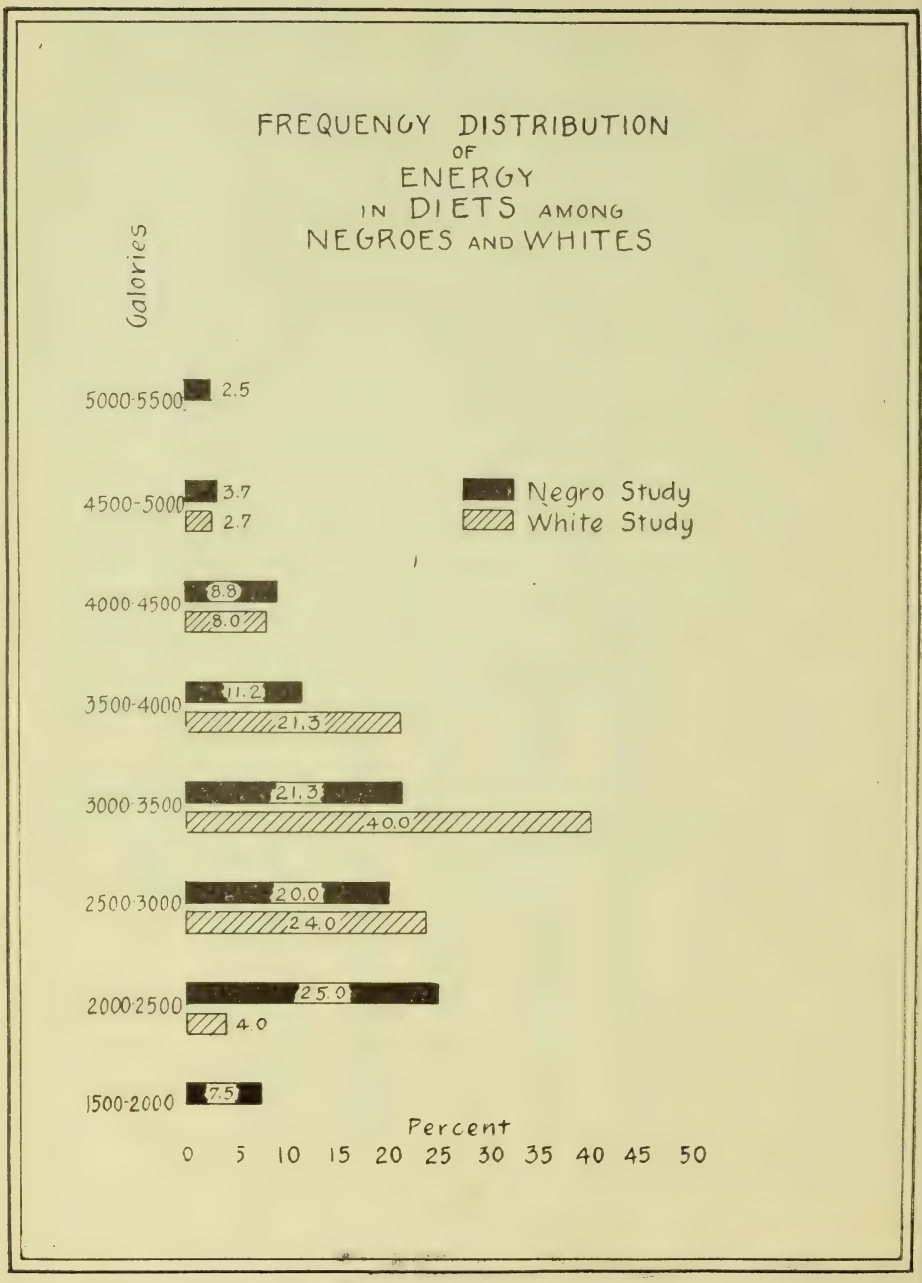

Fig. 6.—Frequency distribution of energy in diets of negro and white families.

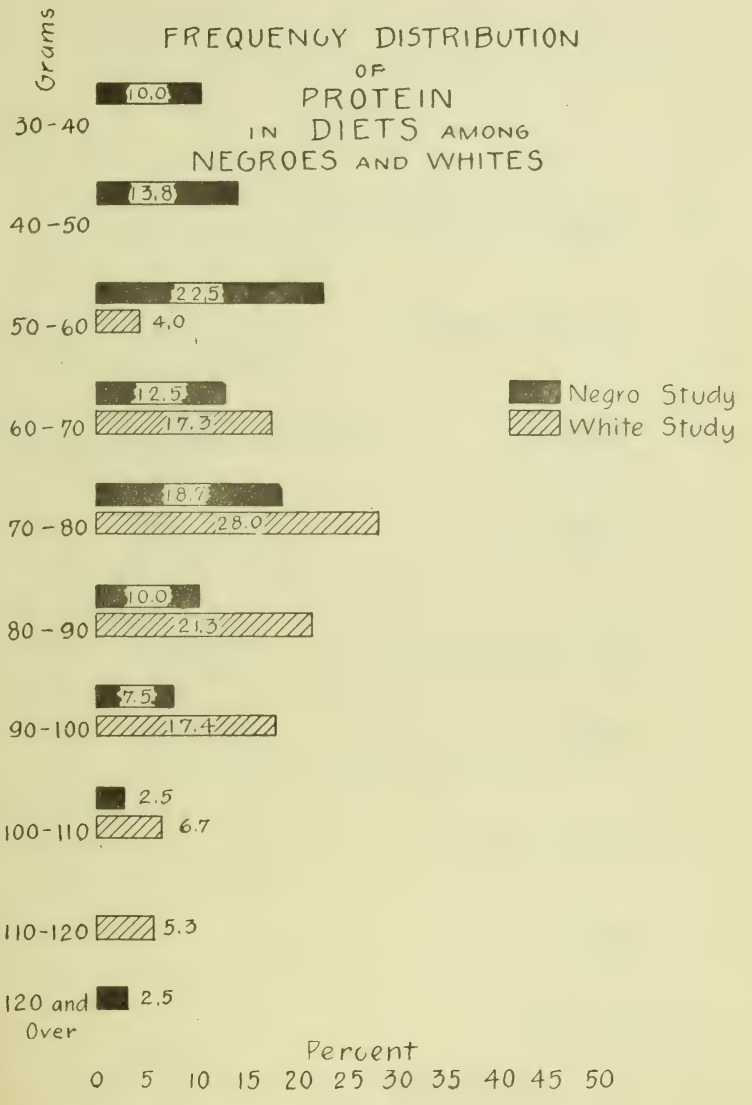

Fig. 7—Frequency distribution of protein in diets of negro and white families.

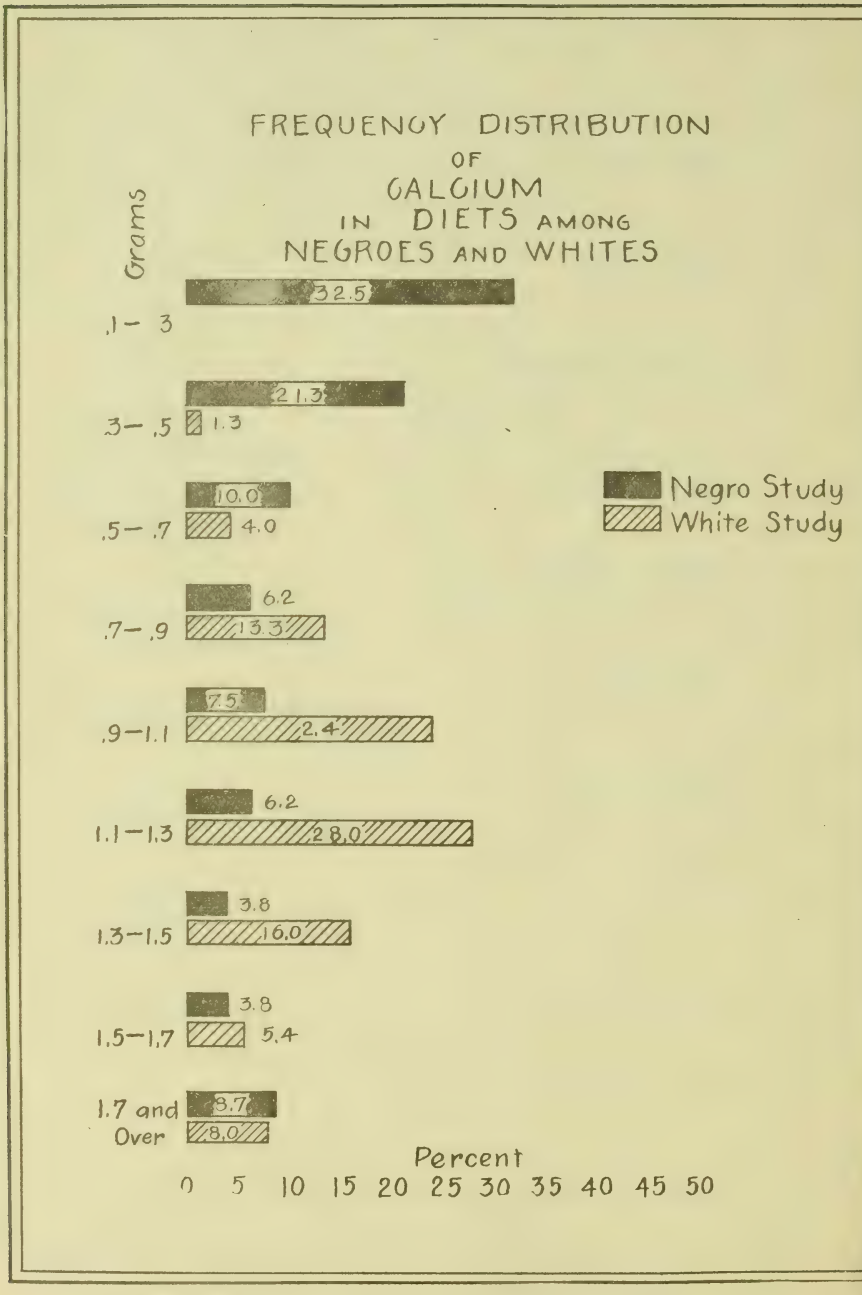

Fig. 8.—Frequency distribution of calcium in diets of negro and white families.

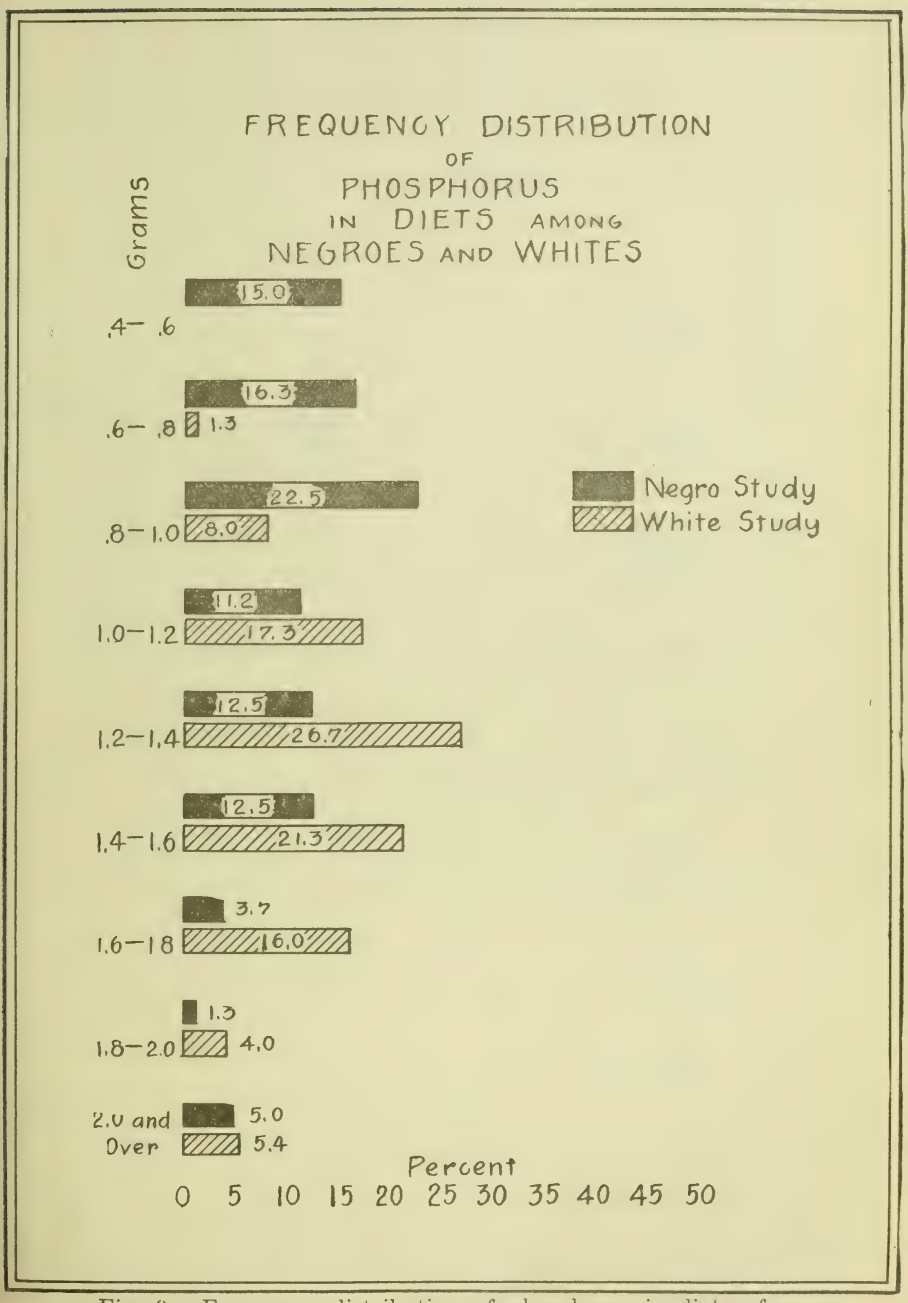

Fig. 9.—Frequency distribution of phosphorus in diets of negro and white families.

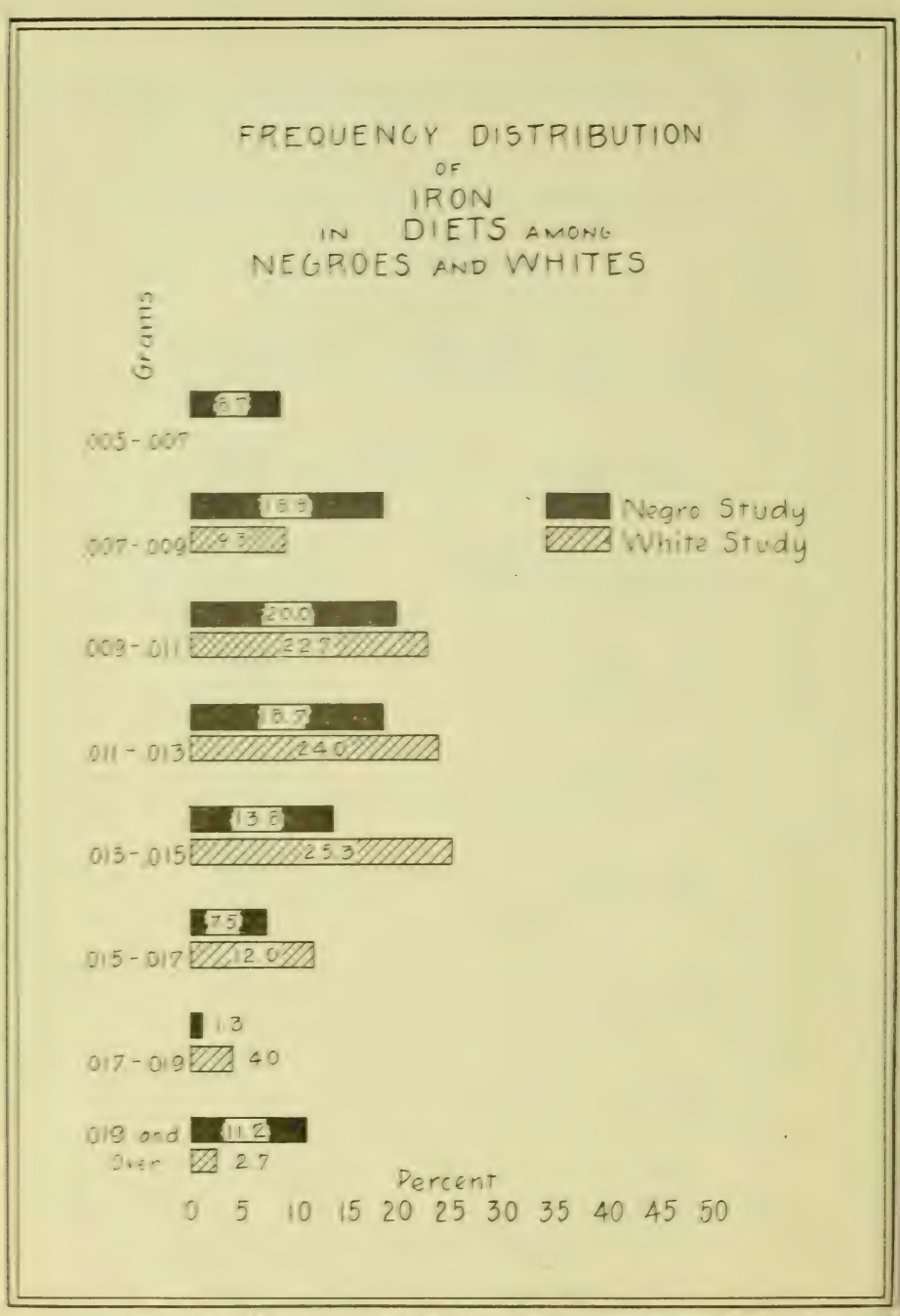

Fig. 10.—Frequency distribution of iron in diets of negro and white families.

COMPARISON OF RESULTS WITH A SIMILAR STUDY CONDUCTED IN ALABAMA

In the latter part of the Nineteenth century a food consumption study was conducted among negroes living in Alabama. This was under the general direction of Dr. W. O. Atwater. Some of the families in this study were plantation laborers as were the Mississippi families. Therefore data from the Alabama study will be used for comparative purposes.

Only general comparisons can, however, be made, for the dietary scale used in the Atwater Study is from 5 per cent to 10 per cent below that of the scale used in this study. This is, however, offset by the fact that 10 per cent was deducted for plate scraps in this study whereas the figures reported in the Atwater study represented both food purchased and eaten. Therefore average figures as they now stand will be used in making some general comparisons of food consumption between these two groups.

The Alabama study included families who had been under the influence of Tuskegee as well as families in regions remote from such an influence. The energy in their daily food averaged 3,270 calories per man per day. Whereas the energy value of the Mississippi dietaries averaged 3046 calories 1| per man per day. The protein of the Alabama negroes averaged 62 grams per man per day. The protein of the Mississippi negroes averaged 66 grams per man per day. This means that they showed the same marked peculiarity that the Alabama dietaries showed—low protein.

One should not hastily conclude from these figures that the negro diet today is no better than it was in 1895. The fact that these figures tally so closely is due to the fact that a number of the families included in the Alabama study were thrifty land-owners and renters whose living conditions as far as food consumption was concerned, were as good as any negro of today. For instance, the father in one of the families included was a carpenter living near Tuskegee Institute. This family during a period of two weeks used the following foods: beef, mutton, chicken, bacon, lard, eggs, butter, milk, sugar, wheat flour, cornmeal, rolled oats, molasses, evaporated apples, and strawberries. Dietaries from people with better advantages would naturally raise the general average.

What of those families living in regions remote from the influence of Tuskegee? What of those families laboring on cotton plantations, that is, in a position similar to negroes included in the Mississippi study? An extract from a letter from one of the investigators of the Alabama study states, "Cornmeal is mixed with water and baked on the flat surface of a hoe or griddle. The salt pork is sliced thin and fried until very brown and much of the grease fried out. Molasses from cane or sorghum is added to the fat, making what is known as "sap," which is eaten with the cornbread. Hot water sweetened with molasses is

1| Figured on same basis as were the Alabama Dietaries.

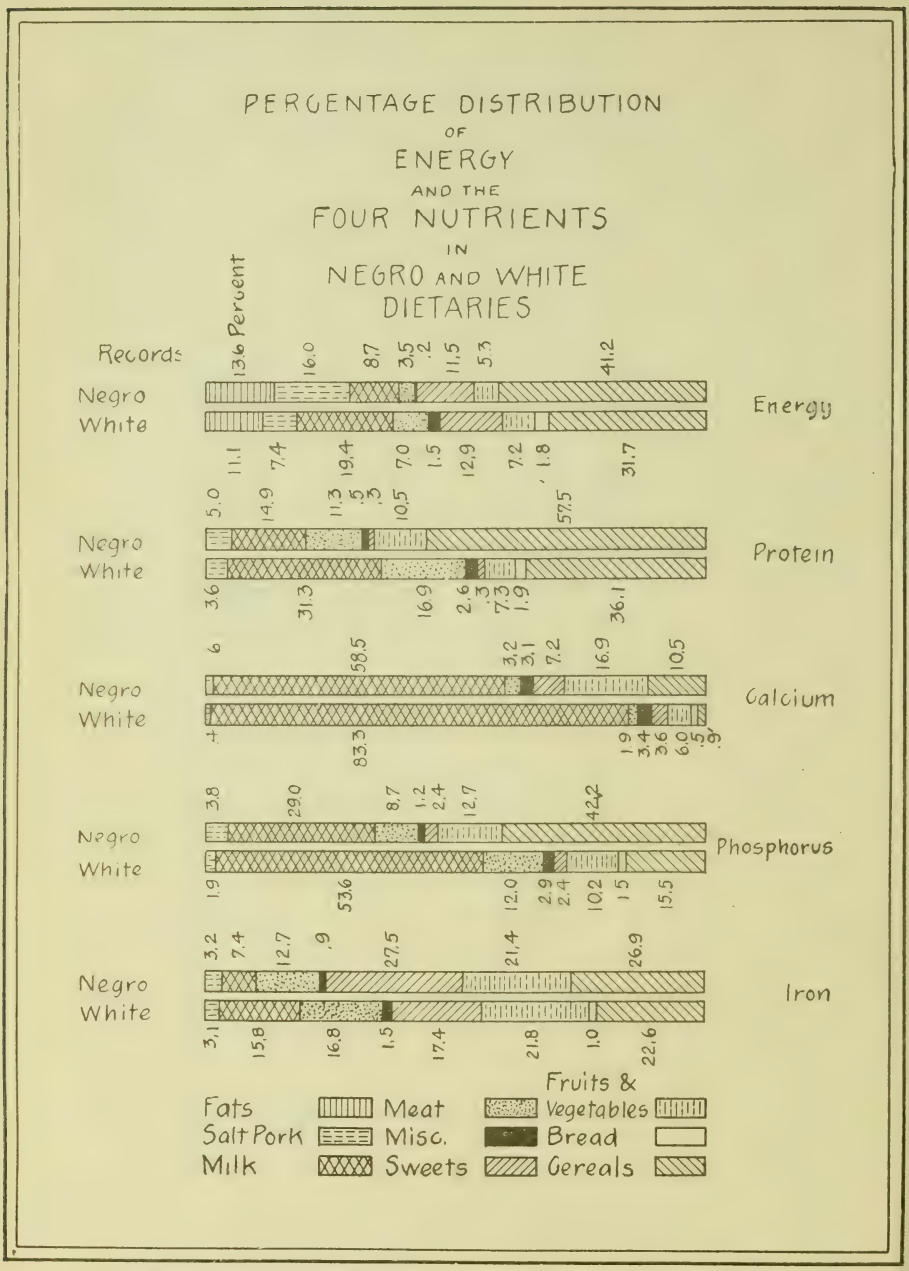

Fig. 11.—Percentage distribution of energy and the four nutrients among the various food groups in food consumption studies conducted among negro and white families of Mississippi.

used as a beverage. This bill of fare is used in most of the cabins on the plantations of the "Black Belt" three times a day during the year." In no case was the food supply of the Mississippi negro so limited.

Table 6.—The distribution of energy 1| among the various food groups in food consumption studies among negro and white families compared with standard of good nutrition suggested by Rose [52] for very economical dietaries.

Study	Meat, eggs cheese	Milk Cream	Fatty Foods	Sweets	Cereals and Bread	Fruits Vegetables
	Percent of total calories	Percent of total calories	Percent of total calories	Percent of total calories	Percent of total calories	Percent of total calories
Standard	5-10	20-25	10-12	10-12	30-40	12-15
Negro Families	3.5	8.7	29.6	11.5	41.2	5.3
White Families	7.0	19.4	18.5	12.9	33.5	7.2

1| A record of the amount of milk brought in each day and the amount of whole milk, buttermilk, skim-milk, butter, and cream sold, given away, or fed to animals was kept. The milk group therefore contains milk products as well as milk. Large quantities of cornbread made with buttermilk, and often eggs were fed to animals in study among white people. This was deducted from the cereal group.

As will be noticed later in this report 47½ per cent of the families owned milk cows. Twice this number of white families owned them. Milk did not appear on 12½ per cent of the negro records. This means that not even an ounce of milk was used in ten of these homes during the month of the study. In a number of cases only a pint, quart, or half gallon given by a neighbor was used. With such a condition, is there any wonder that milk furnished only 8.7 per cent of the calories? Is there any wonder that these dietaries were found deficient in so many of the necessary factors?

As the study was conducted during egg season, egg consumption was undoubtedly higher than usual. In fact, the use of eggs was nearly as great as that of meat, fish, and poultry combined. At that, it averaged only 2½ eggs per family per day.

Fig. 12.—Negro children are required to assist with farm work at an early age.

Meat consumption in the home of the average tenant is doubtless low at all times. Yet, planters say, "Our negroes eat too much meat." The negroes themselves say, "We eat too much meat." How can these, seemingly, conflicting statements be explained? When using the word meat, the planter or negro means, salt pork. What they should say is, "Negroes eat too much fat." This would better state the case.

Meat need not necessarily furnish a high proportion of the calories to give an adequate dietary. Indeed, an adequate dietary can be built around extremely small quantities of food from this group, in which case care must be taken to provide right porportions of the other food groups. Such provision was not made by these families.

Diets, as low in milk and meat as these, will perhaps explain the prevalence of pellagra in the Delta and among negroes in particular. Those advocating the Goldberger theory would say because of small quantities of fresh milk and meat these diets had very little of the P-P factor, whereas, those advocating the infection theory would say that organisms group and multiply in the intestines of people on such carbohydrate diets as these.

It is interesting to note that white people and negroes used about the same amount of flour and cornmeal per family per week. The higher proportion of calories furnished by cereals in the negro study is due to two facts: (1) the white people had a greater variety and amount of other foods; (2) the white people fed large quantities of biscuit and cornbread to animals.

As with white people, flour consumption was higher than cornmeal consumption. Mississippi people, whether they be white or black like biscuit. Flour is one of the staples issued by every commissary.

Fig. 13.—A pellagra patient from the Mississippi Delta. Notice the "gloved" hands, "neckless," and ulcerated mouth. She had been under treatment one week when picture was taken.

An average of .075 pounds of baker's bread per family per month was used. This means that it is not yet a common food in the diet of the negro tenant.

The use of whole grained cereals is important in a dietary where more than one fourth of the calories come from the cereal group. Yet, whole wheat flour was not used by a single family. An average of about one ounce of oatmeal per family per week was used. A part, at least, of the large quantity of refined cereals should be replaced by whole grained cereals, as whole grained cereals are richer in minerals and vitamins.

Only 5.3 per cent of the calories came from the fruit and vegetable group, which was less than half the minimum recommended by Rose for low cost dietaries. At the time of the study, many of these negro families had used up their supply of sweet potatoes. This was not true in the February Study among white families of the Brown Loam and Short Leaf Pine Areas. The rural whites of these two areas usually raise enough sweet potatoes to last well into spring. Chiefly, because of the difference in the use of potatoes; and sweet potatoes in particular a lower proportion of calories were furnished by fruits and vegetables than in the food consumption study among white people.

The large proportion of calories furnished by sweets was due to the amounts of cane syrup used. Negroes like molasses and eat a great deal of it especially in fall, winter, and early spring.

Negro dietaries seem to have two distinct characteristics, low protein content and high fat content. Fats furnished over one-fourth of the calories in these negro dietaries. A diet so largely made up of lard and salt pork would explain a number of the deficiencies.

The results of this dietary study conducted among negro tenants were similar in a number of respects to the results of the dietary study conducted among white people in Mississippi. For instance, meats, fruits, and vegetables were low in both studies, whereas fats and cereals were fairly high in both studies. The main difference in these dietaries was in the use of milk. The large amount of milk used by the white man resulted in a much better diet for the white man, a diet containing more protein, calcium, and phosphorus than that of the negro.

Table 7.—Average quantity of some common foodstuffs consumed during one month by 80 negro families and 100 white families.

Kind of Food	Average amount per Adult—male unit		Kind of Food	Average Amount per adult—male unit	
	Negro families	White families		Negro families	White families
	Pounds	Pounds		Pounds	Pounds
Flour	13.00	12.69	Eggs	2.16	3.95
Rice	1.54	1.08	Cheese	.16	.27
Oatmeal	.07	.31	Fresh Apples	.06	1.44
Bread	.02	1.18	Canned B. Berries	.17	.97
Cornmeal	9.52	8.08	Dry Peas	1.42	.42
Sugar	2.16	4.29	Turnip Greens	1.16	1.29
Cane Syrup	4.90	3.89	Canned Tomatoes	.31	1.29
Jelly and Preserves	.16	.96	Sweet Potatoes	1.73	5.74
Lard	3.00	2.53	Irish Potatoes	.24	1.33
Salt Pork	3.98	2.21	Onions	.09	.25
Sausage	.37	1.32	Cabbage	.76	.45
Pork	.77	2.50	Lettuce	.01	.02
Beef	.60	.69	String Beans	.10	.09
Salmon	.05	.11	Collards	.09	.72
Fresh Fish	.40	0	Canned Corn	.01	.05
Poultry	.39	.73	Pickle	.12	.38

Because of difference in the amount of edible food fed to animals, such a list serves mainly as a basis for general comparisons.

Only nine foods—flour, rice, cornmeal, cane syrup, lard, salt pork, fresh fish, dry peas, and cabbage, of the thirty-two listed, were used in more generous quantities by negroes. Rabbit appeared on ten out of the eighty negro records. The negroes in one study used more rabbit and fresh fish that were used by the white people during the entire year of their study. O'possum appeared on one negro record. This meat was not used by white people.

As practically all foods which build muscle, promote growth, and regulate body processes were used in greater quantities by the white people a discussion of the use of any of these foods would be favorable to the whites.

The greatest difference found in the use of any food, was that found in the use of milk. White families used about three times as much milk as negro families.

DISCUSSION OF VITAMIN CONTENT OF DIETARIES

The human body requires more than protein, fats, carbohydrates, and mineral elements. A generous supply of vitamins is essential as well. Within the next few years quantitative figures on vitamin content of food-stuffs will probably be made available. At the present time, it is possible to draw only a few general conclusions as to vitamin content in a dietary.

A diet composed as largely of cereals and fats, as are the diets of these negro tenants, is very apt to be deficient in vitamins.

These dietaries furnished on the average per man per day basis

around one cup of milk (part of which was buttermilk), one half an egg, and one ounce of leafy vegetable. This, of course, meant that a great number were deficient in vitamin A. Is this by any chance, one reason why negroes are so susceptible to tuberculosis?

Vitamin B is very widely distributed in nature and yet in dietaries so largely composed of refined cereals and fats, it seems probable that a number were deficient in this vitamin.

As has been previously stated, these studies were conducted in February and March. There are seasons in Mississippi in which a generous milk, vegetable, and fruit supply is more easily obtained. Thus, the vitamin content of these dietaries was perhaps lower than it would have been two or three months later. The February and March season did not show dietary conditions at their best nor at their worst. At the time of the study a few of the families had a spring garden containing turnip greens and onions, and a number had hens that were laying ten or twelve eggs a day. The majority were using large quantities of pure cane syrup.

A liberal supply of milk, whole grained cereals, fruits, and vegetables, foods containing generous amounts of vitamin B, are essential for best growth and health. These negroes were certainly not getting this supply.

Sherman [56] states that, "It has been estimated that the daily amount of vitamin C that a man must have to protect him from scurvy is about the amount contained in one ounce of orange or lemon juice or canned tomato or raw cabbage or onion, or in about one pound of cooked cabbage or potato, or in a pint of milk. But, it is now becoming plain that the amount of vitamin C which we must have to protect us from scurvy is only a fraction of the amount which is really needed for full health and vigor; and instead of reliance upon any one of the items just mentioned as possible minimum sources of vitamin C, the equivalent of several of them should be supplied in each day's food."

Such small amounts of foods rich in this vitamin were used during the study. Averages such as: .06 pounds of fresh apples per man per month; .09 pounds of onions per man per month; .01 pounds of lettuce per man per month; .31 pounds of tomatoes per man per month, cannot be counted on to furnish sufficient amounts of this important vitamin.

Of the sickness records sent in by planters, on whose plantations these studies were conducted, about four times more negroes were treated for infectious diseases than for any other type. Perhaps lessened resistance caused by vitamin deficiencies was one of the factors bringing about this condition.

Howe[25] states that, "Although one cannot say that dental caries is not due, in part to an external process, still, according to experiment on guinea pigs, extensive decalcification of teeth and of some parts of the bones is brought about by a disturbance of metabolism induced by scorbutic feeding." This means that a sufficient quantity of vitamin C is one of the factors in the formation of good teeth.

From figures obtained from county health officers, it seems that

Fig. 14.—A 3½ year old girl from the Yazoo-Mississippi Delta. Notice evidence of rickets, as barrel chest, "pot belly," and bowing of legs. This child had been under treatment several months when this picture was taken.

negro children of Mississippi have superior teeth to those of white children. This indicates that good teeth are not wholly dependent on good diet. Perhaps soundness of teeth is an hereditary characteristic of the negro as is thick cranium.

There are three factors which are to be considered in rickets: (1) the proportion of calcium and phosphorus supplied through the blood, (2) antirachitic vitamin, (3) ultra violet irradiation. This diet of ce-

reals and fats did not adequately provide the first two factors. One would then expect rickets to be prevalent in such a group.

It was impossible to secure records pertaining to the frequency of rickets among negroes. One county health officer from a Delta county stated, "We do not give physical examinations to colored children as it is not possible with our limited personelle. However, from experience in clinics and with the colored race in general, I have no hesitancy in giving as my opinion that rickets is at least twice as prevalent among colored children as among whites." Another health officer from one of the southern counties writes, "We do not give physical examinations to colored children and thus cannot furnish any figures on prevalence of rickets in this county. Rickets is not one of our problems. Nutrition on the other hand is one of the greatest problems we have to meet." Whereas, a child specialist from Jackson writes, "It is my observation borne out by case records that rickets is more prevalent among wihte children than among black."

That rickets is not more widely spread among negro children in Mississippi is due to abundance of sunshiny weather. The majority of negro mothers work in the field. The negro child is generally scantily clad and spends a great deal of time out of doors. A ride through a plantation in the early afternoon of a warm August day, would find negro men and women as well as negro children fast asleep in the glaring sun. By this means vitamin D can be produced in abundance so that even without mineral additions, a rachitic condition can be much improved. Diet is of fundamental importance but sunlight is often the determining factor.

Energy and Nutritive Value of Edible Food Fed to Animals, Sold and Given Away

Edible food fed to animals was composed largely of cornbread. Only 18 pounds of vegetables were fed to animals during the month of study. The value of the food fed to animals, sold, and given away 1| was enough to meet the daily requirements for: energy—179 men; protein—338 men; calcium—103 men; phosphorus—56 men; iron—161 men.

From this data, it would seem that a number of housewives were selling or feeding to animals food which was needed by their families. This was true in only a few cases. The housewife who fed cornbread to chickens usually had plenty of cornbread for her family. The negroes, unlike the whites, fed very little milk to animals. The majority of housewives sold their surplus milk to neighbors. In this way, a number of families without milk cows, were given a regular milk supply.

PROBABLE EFFECTS OF SUCH DIETARIES ON HEALTH AND EFFICIENCY

Long continued use of inadequate diets results in defective physical condition, lessened capacity for work, increased amount of illness,

1| Eggs sold not included in this tabulation.

higher death rate, lower resistance to epidemic diseases. Underfeeding is indeed an important factor in arrested physical and mental development.

If these diets are typical of the plantation negro, they explain, at least, in part the high death rate, the frequent illnesses, and the lack of energy of negroes as compared to whites. Of course, family sanitation and other factors have a bearing on this question, but diet has an influence which is certainly not less than the other factors.

In one year, twenty families 1| included in the study spent $77.75 for drugs and had 61 doctor visits. Making allowance for difference in size of family, these negroes spent more for drugs than did white people included in the study made in the Short Leaf Pine Area and the Brown Loam Area of Mississippi. There were, however, a greater number of doctor visits paid the white people. This was doubtless due to the fact that many could not afford to pay for doctor visits. Some may not have realized the need of a doctor.

The death rate is higher in Mississippi among negroes than it is among whites.

Lack of proper food, as is evident from this study, is bound to have a bad effect on the children as well as the adults. The child probably suffers more from these deficiencies for he has less resistance than the adult. He must have food for growth as well as for maintenance. On the other hand, this poor diet is perhaps one explanation for the reduced efficiency of the negro adult as compared to that of the white adult.

GENERAL FOOD FACTS

METHODS OF COOKING USED

A record of menus served for one week during the study was kept in each home. This record served: (1) as further check on accuracy of food record, (2) as a means of obtaining a better idea of combination of foods made than a list of amounts used over a period of time could give.

The foods used were simply prepared. Frying and boiling were the methods of preparation in general use. Salad was not used in a single one of the menus. Few desserts were used, the most common of these being sweet potato pie, rice pudding, and cake.

One of the home demonstration agents writes, "Eggs are generally well done even for children. Vegetables are over cooked in fat. Cornbread is usually made of cornmeal, salt, and water, and that, too, is fried. Most of the meat is fried done and hard."

Mississippi people, both negro and white, consume more fats than do their northern friends. It has been suggested that climatic conditions are a factor. On the other hand perhaps high consumption is

1| Records obtained from planters.

due to habit or custom in preparation of food.

Negroes are not "natural born cooks" as some seem to think. It is due to careful training that they have won this reputation. Cookery as done in the average home is poor. Food, whether it be a meat or a vegetable, is usually over-done as well as greasy.

Yet, there is a brighter side to this question. A number of housewives, under the influence of home demonstration agents are learning new and better methods of food preparation. One home demonstration agent writes, "My club members are learning to make good yeast bread and they enjoy it."

USE OF CONDIMENTS AND BEVERAGES

The food records did not include those products without food value such as beverages and condiments. It was possible though, through personal interview and a study of the menus sent in to obtain a fairly good idea of the use of these articles.

Coffee is used in a number of homes, though its use is not as great as among white people. There were a number of menus sent in, in which neither milk nor coffee was used. In few cases is this true in homes of white people. One negro recorded serving hot water for breakfast, which may have been the case in several instances. Coffee is the only beverage of this class which was used to any extent. Tea is seldom used.

The use of pepper, spices, catsup, pickles, that is, highly seasoned foods, was not as great among negroes as whites. Negroes, as a general rule, do not care for sour pickles. An explanation for this difference seems to lie in the fact that the white man has had more opportunity to develop tastes for these abnormal flavors, rather than that there is any distinct difference in sense of taste between these two people. The use of condiments among rural people, whether they be black or white, is certainly not great enough to cause alarm.

FOOD LIKES AND DISLIKES

If the negro was given $1.00 to buy meat, he would purchase fish, or pork, whereas the white man would purchase beef. Mississippi people both colored and white like chicken. The reason it is not served more often is because, "one must not eat up in a week or two the few chickens one has."

Of all food classes, there were more dislikes in the vegetable group than in any other. There were a number who disliked almost every vegetable but potatoes. Fewer negroes dislike strongly flavored vegetables than do whites. In fact, the majority of negro families would serve turnip greens, cabbage or collards daily if they had a convenient supply on hand. Many vegetables commonly used among the whites are unknown to negroes. There are a number who have never tasted such vegetables as egg plant, peppers, asparagus, spinach, and carrots. There are a number who have eaten these only once or twice, that is, not often enough to acquire a taste for them.

Negroes are very fond of butter milk. A number of the women in

the study stated that their children preferred buttermilk to sweet milk. This was not often true of the white children. Many negroes make their supper meal off of cornbread and buttermilk. The question of increasing milk consumption among them seems to involve making the supply accessible rather than making it popular..

The white child wants Santa to put an orange in his stocking, whereas the negro child asks for a banana. Candy or drinks with a banana flavor find a ready sale among negroes. Both people are fond of apples. Negroes as well as whites are very fond of sweets in practically all forms. Negroes prefer colored sugar candy, whereas whites like chocolate.

"The reason negroes use such a small variety of food," states a negro home demonstration agent, "is because they don't know about a number of foods commonly used among white people. There are negroes who haven't even tasted ice-cream." Mary, a rather industrious negro woman, told her neighbor, Susan, about how well her family liked macaroni and cheese. Susan, who had never served or tasted this dish, purchased the materials and cooked it for her family. Her family would not eat it because it was too "starchy and gummy." The majority feel that they have too little cash to spend on something which they perhaps cannot properly prepare or which, if they can, the family probably will not like.

Through agricultural extension work, the negro housewife is gradually increasing the variety and improving the methods of preparation and cookery of foods. Much has already been done, but much remains to be done in this field.

FOOD COMBINATIONS

Skill is combining as well as in preparing foods is an important point in getting them eaten. The menus served in the homes of these tenants have been divided into three groups and a typical one selected from each group.

ONE OF THE BETTER MENUS

Monday

BREAKFAST	DINNER	SUPPER
Fried Eggs	Rabbit	
Salt Pork	Cornbread	Rabbit
Biscuit	Rice pudding	Biscuit
Molasses	Milk	Tea cakes
Milk		

Tuesday

Fried Eggs	Chitlings	
Biscuit	Cornbread	Chitlings
Molasses	Molasses	Baker's Bread
Rice pudding	Milk	Milk

Wednesday

Sausage	Peas	Sweet Potato Pie
Cornbread	Cornbread	Biscuit
Molasses	Milk	Butter
Milk		Molasses
		Milk

Thursday

Canned peaches	Salt pork	Cornbread
Rice	Cornbread	Butter
Biscuit	Rice Pudding	Molasses
Butter	Milk	Milk

Friday

Fried Eggs	Cabbage	Fried Eggs
Fried Potatoes	Cornbread	Biscuit
Biscuit	Peach Pie	Butter
Butter	Milk	Molasses
Molasses		Milk

Saturday

Biscuit	Fried Potatoes	Fried Eggs
Butter	Salt pork	Biscuit
Molasses	Cornbread	Butter
Milk	Milk	Molasses

Sunday

Fried Steak		
Biscuit	Cabbage	Cabbage
Butter	Cornbread	Cornbread
Molasses	Tomato pie	Molasses
Tea cakes	Milk	Milk
Milk		

A Typical Menu

Monday

BREAKFAST	DINNER	SUPPER
Fried Eggs		
Biscuit	Peas	Peas
Sorghum	Cornbread	Cornbread

Tuesday

Salt pork	Turnip greens	
Biscuit	Biscuit	Milk
Sorghum	Biscuit pudding	Biscuit pudding

Wednesday

	Salt pork	
	Cornbread	Fried potatoes
Biscuit	Biscuit pudding	Biscuit
Sorghum	Milk	Sorghum

Thursday

Fried Eggs	Peas	Fried Eggs
Biscuit	Cornbread	Biscuit
Milk	Cake	Sorghum
		Cake

Friday

Pears (canned)	Rice	Salt pork
Biscuit	gravy	Biscuit
Milk	Cornbread	Sorghum

Saturday

		Fried Steak
Rice	Milk	Rice
Biscuit	Cornbread	Gravy
Sorghum	Tomato pie	Biscuit

Sunday

	Sausage	
Salt pork	Boiled Cabbage	Sausage
Biscuit	Rice	Rice
Sorghum	Cornbread	Cornbread

One of the Most Inadequate Menus

Monday

BREAKFAST	DINNER	SUPPER 1‖
Rice		
Cornbread	Peas	
Coffee	Cornbread	

Tuesday

Rice		
Cornbread	Peas	
Coffee	Cornbread	

Wednesday

Rice		
Cornbread	Peas	
Coffee	Cornbread	

Thursday

Rice		
Cornbread	Peas	
Coffee	Cornbread	

Friday

Rice		
Cornbread	Peas	
Coffee	Cornbread	

Saturday

Rice		
Cornbread	Peas	
Coffee	Cornbread	

Sunday

Rice		
Cornbread	Peas	
Coffee	Cornbread	

1‖ Menus of a family during "laying off" season. Dinner served at 4:00 p. m., no supper served.

Cake or pie is more likely to be served in rural homes of Mississippi than is salad. Salad was seldom used by the white housewife,

never used by the negro housewife.

In many cases the negro housewife could not have improved food combinations without increasing variety of foods used. This was seldom true of the white housewife. After reading over the menus served in these eighty negro homes, one concludes that a change should be made, even if only to break monotony. The negro woman needs to be taught how to serve attractive as well as adequate meals.

EFFECT OF HOME GROWN PRODUCTS ON ENERGY AND NUTRITIVE VALUE OF DIETARIES

Table 8.—A comparison of the calcium content of the average diet of families with no milk cows with one milk and with more than one milk cow.

Milk Cows	Percent of Total Cases	Calcium Per Man Per Day
Number	Percent	Grams
No Cows	52.5	.358
One Cow	32.5	.928
More than one	15.0	.789

Table 9.—Comparison of the energy and nutritive value of average diet of the group with no milk cows and group with one or more milk cows.

Type of Record	Records	Energy and nutritive value per man per day				
Families with no milk cows	Number 42	Energy Calories 3064	Protein Grams 60.072	Calcium Grams .358	Phosphorus Grams .807	Iron Grams .0121
Families with one or more milk cows	38	3026	72.804	.884	1.344	.0120

One cow seems to be the best provision as far as the calcium supply is concerned. Negro families owning more than one cow usually sell milk or milk products . Consequently, the calcium content of their dietaries is not quite as high as the dietaries of those having only one cow.

The average energy and nutritive value of dietaries from the group of Delta negroes owning cows is somewhat similar to the average found among 100 white families living in the Short Leaf Pine and Brown Loam areas. The dietaries of negroes with no milk cows were more often deficient in protein, calcium, and phosphorus than were the dietaries of negroes with milk cows.

Table 10.—Average iron content in diets of families with no garden, with no fruit trees, preserving less than five gallons of food each year and having less than one dozen hens compared with iron content in diets of families well provided with these.

Item	Cases having item		Cases not having item	
	Percent	Iron per man per day	Percent	Iron per man per day
		Grams		Grams
Garden	52.5	.0126	47.5	.0115
Fruit trees	47.5	.0122	52.5	.0120
Food Preserved	67.5	.0122	32.5	.0119
Hens	72.5	.0125	27.5	.0110

47.5 per cent of the families enrolled did not have a garden during the study but only 6.25 per cent record not having a garden sometime during the year. The average family has a garden which provides at least one vegetable during six months in the year. That means that during twenty-six weeks they must depend entirely on preserved or purchased foods. The average family preserved 47½ quarts of fruit, vegetables, and meat per year. This means less than 2 quarts of food per family per week during the time in which the garden is not bearing. Herein, lies one explanation, for the deficient dietaries of these negro tenants.

An average per family of 3.8 fruit trees (including those bearing and not bearing) was found. There were fewer families without poultry than any other home raised product. The average family owned 26.3 hens.

The above tables show that there is a relation between consumption and production. That is, if the farm does not provide milk, if the farm does not provide vegetables, if the farm does not provide poultry, then the diet suffers.

THE EFFECT OF SALE OF FOOD RAISED ON THE FARM ON ENERGY AND NUTRITIVE VALUE OF DIETARY

Just what effect does a yearly income of twenty-five dollars or more from sale of these products have on the energy and nutritive value of a dietary? The value of dietaries of the twelve families coming in this group was as follows: energy 2,661 calories per man per day; protein 58.99 grams per man per day; calcium, .638 grams per man per day; phosphorus .921 grams per man per day; iron, .0127 grams per man per day. This average was below the per man per day value for the entire study in energy, in protein, and in phosphorus. On the other hand the average dietary of white families, selling quantities of food raised at home, was above that found for their entire study in energy, in protein, in calcium, in phosphorus, and in iron. Thus, it can be said that negro families are more likely to sell food raised at home than are white families. The fact that milk consumption was highest with two milk cows for whites, with one milk cow for negroes seems to support this assumption also.

Table 11—Value of the Average Diet on the Three Types of Plantations in Terms of Energy, Protein, Calcium, Phosphorus, and Iron

Form of Settlement 1/	Records	Energy and nutritive value per man per day				
		Energy	Protein	Calcium	Prosphorus	Iron
	Number	Calories	Grams	Grams	Grams	Grams
Supplies	39	2998	63.95	.66	1.02	.0117
Cash	31	2967	67.74	.73	1.11	.0126
Part Cash Part Supplies	10	3483	69.59	.61	1.08	.0119

1/ The term settlement is understood to be business relation of tenant and operator throughout the season.

There seems to be very little difference in the dietaries of families living on these different types of plantations. Yet, a number of planters refuse to adopt the cash settlement plan for they believe the negro will spend his cash immediately on trifles, thus putting himself in no condition to work for the greater part of the month. These averages suggest a more thrifty class of negro on the cash settlement type of plantation. However, records from this study are probably too few to draw any definite conclusions.

MONEY VALUE OF FOODS USED

The average money value of food consumed per man per day was 21 cents; per week, $1.47; per year $76.44. The average value of food consumed per family per year was $330.14. This is slightly above the average of $284.30 found by Kirkpatrick [30] for 72 negro croppers from Kentucky, Tennessee, and Texas.

Cash expenditure for food amounted to 32 per cent of the negroes' income, only 11 per cent of the whites' income.

In dietary studies conducted among negroes of Alabama [2], Virginia [13], food was valued at current retail prices as in this study. Raising the cost per man per day to the price level of 1927, the average for the Alabama study would be 19 cents; for the Virginia study, 26 cents. One would naturally expect the somewhat poorer diets of Alabama to have a lower money value, the high protein diets of Virginia to have a higher money value than those of Mississippi.

In the study made by U. S. Bureau of Labor Statistics in 1918, $153.00 per man per year was spent. When adjustments are made to provide for difference in price level, we find that the same food would have cost the working man about $141.00 at the time of this study. This means that the laboring man's food was worth about $65.00 a year more than was that of the negro tenant. Then, it is not surprising that the average working man's diet provided more protein and minerals than did that of the negro tenant.

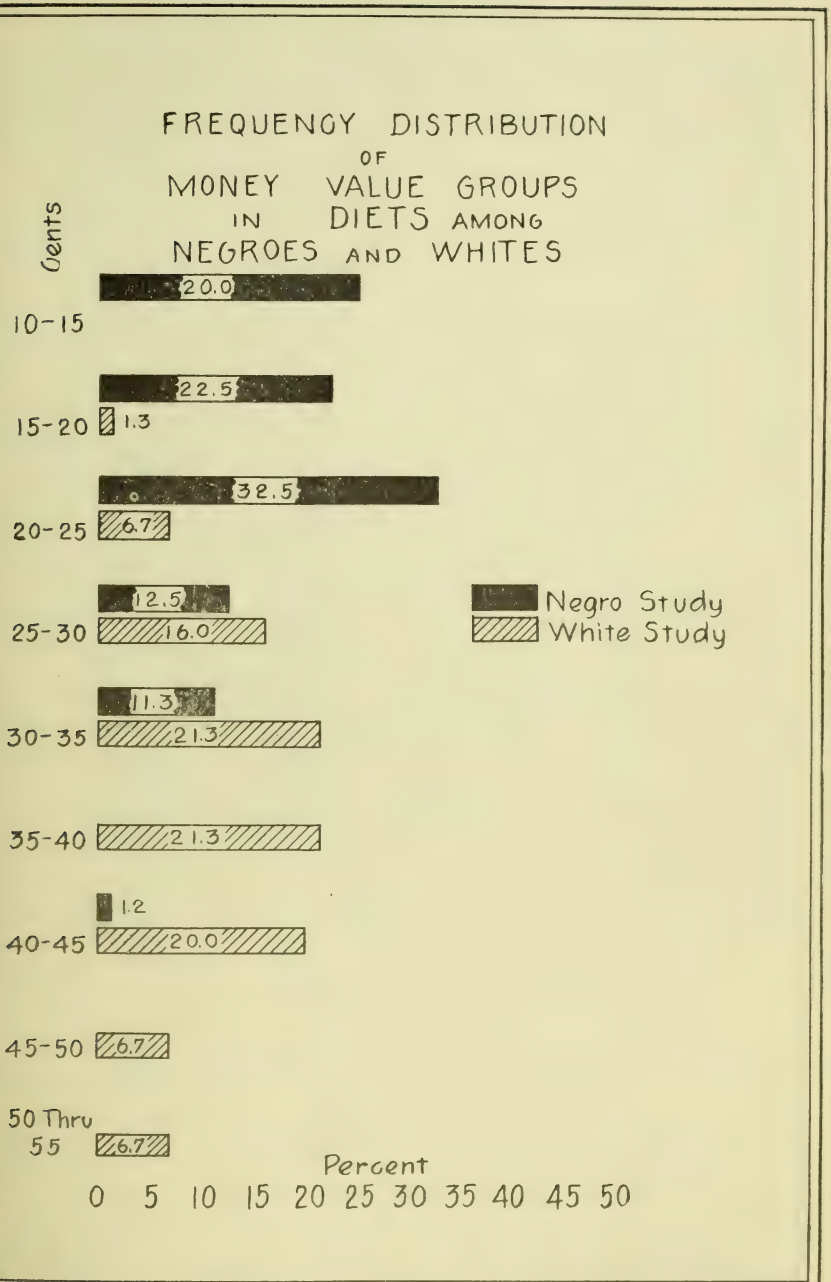

Fig. 15—Frequency distribution of money value in diets of negro and white families.

Fig. 16—Percentage distribution of money value among the various food groups in food consumption studies conducted among negro and white families of Mississippi.

The white people from the two soil areas of Mississippi spent a greater portion of their money for meat, vegetables, and milk than did the negroes.

FOOD PURCHASED AND FOOD FURNISHED

44 per cent of food 1| consumed by negro families was raised on the farm—74 per cent by white families. This means that white people raised nearly twice as much of their food as did negroes. Perhaps, this comparison of the figures of the Negro Study conducted in February and March with the figures of the White Study conducted during the four seasons is unfair. Yet, a comparison of amounts furnished by the farm at the same season is scarcely much more favorable to the negro. This poor record of food raised on the farm offers one explanation for the poor diets of these negroes.

The 44 per cent found in this study comes below the average, of 55 per cent, found by Kirkpatrick [30] for negro farmers from Kentucky, Tennessee, and Texas. One rather expects such a difference, for in the Delta cotton often grows up to the very door step.

Table 12—Percent of the different food classes purchased and percent furnished by the farm.

Food	Negro Study		White Study	
	Purchased	Furnished	Purchased	Furnished
	percent	percent	percent	percent
Meat and Fish	65	35	36	64
Fruits	44	56	27	73
Vegetables	70	30	16	84
Dairy Products	18	82	4	96
Poultry Products	3	97	2	98

These figures seem to indicate that the negro housewife is more likely to spend her money for vegetables, meat, or fish than for milk and eggs.

The proportion of the farm diet grown at home [1, p. 482], has been estimated as follows: meat 75 per cent; fruit, 60 per cent; vegetable, 80 per cent; milk and products, 85 per cent; poultry and products, 100 per cent. The Delta negro has much to do as far as food raised on the farm is concerned, before his record comes up to that of the white man living in the Brown Loam and Short Leaf Pine areas of Mississippi.

RELATION OF MONEY VALUE TO ENERGY AND NUTRITIVE VALUE

Table 13—Energy and nutritive value of dietaries from low cost groups per man per day.

Cost per man per day	Records	Energy	Protein	Calcium	Phosphorus	Iron
Cents	Number	Calories	Grams	Grams	Grams	Grams
10	2	1955	40.36	.22	.58	.0092
11	1	2229	32.25	.16	.45	.0070
12	4	2187	38.09	.23	.51	.0077
13	3	3348	49.99	.37	.88	.0082
14	6	2176	49.26	.25	.66	.0094

1| On money value basis.

Table 14—Energy and nutritive value of dietaries from high cost groups per man per day.

Cost per man per day	Records	Energy	Protein	Calcium	Phosphorus	Iron
Cents	Number	Calories	Grams	Grams	Grams	Grams
30	1	3343	65.15	1.16	1.15	.0183
31	3	3818	81.94	1.14	1.32	.0146
32	1	4060	104.49	1.76	2..14	.0154
33	4	3928	105.97	1.74	2.02	.0202
44	1	5248	93.05	1.51	1.76	.0157

33 cents per man per day was the average amount for which an adequate dietary was provided. A food expert might be able to provide adequate food at less than this average. The negro housewife, however, not having a clear knowledge of food values must needs spend more to take care of errors.

It is of vital importance that a people with such a small food allowance, as these tenants, learn how to select cheap foods to make a balanced and attractive dietary. Low expenditure should not imply low food value, but as long as the the housewife has an inadequate knowledge this will be true. Of course, there is a cost limit with which even knowledge is not able to provide an adequate dietary. The Delta negro with land and time at his disposal does not come in this class.

RELATION OF INCOME TO FOOD EXPENDITURES

Table 15—Cost per man per day of dietaries from families in high and low income groups.

Cost per man per day	Income per Man per Year	
	$175 and above	$100 and below
cents	Number of cases	Number of cases
10	0	1
11	0	1
12	1	1
13	0	2
14	1	2
15	1	0
16	0	0
17	1	2
18	0	3
19	1	2
20	2	2
21	1	2
22	1	2
23	1	0
24	2	2
25	2	0
26	1	0
27	1	0
28	2	0
29	1	1
30	0	0
31	1	2
32	0	0
33	4	0

The money value of dietaries per man per day of families in the low income group averaged 19 cents, in the high income group 24 cents. It is then evident that inadequate income is at least partly responsible for low cost diets, which are in turn partly responsible for poor diets.

Higher incomes would not entirely solve these dietary problems but higher incomes would provide a "defense by which the effects of ignorance could be evaded."

Table 16—The distribution of money value among the various food groups for negro families on high and low incomes.

Income Groups	Food Groups 1								
	Fats	Salt pk	Milk	Meat	Misc.	Sweets	Fr. and Veg.	Bread	Cereals
$175 and over	Per ct. 8	Per ct. 13	Per ct. 24	Per ct. 14	Per ct. 1	Per ct. 10	Per ct. 13	Per ct. 0	Per ct. 17
$100 and under	9	16	17	15	1	8	12	0	23

1| Foods groups the same as provided in the Short Cut method for calculating nutritive value of a dietary [19]. Fats include—lard, butter, substitute; salt pork includes—salt pork, bacon, sausage; milk includes—milk as well as milk products; meat includes—meat, fish, poultry, eggs; miscellaneous includes—cocoa, cheese, nuts, cocoanuts; sweets include—sugar molasses, jam, etc.; fruits and vegetables include all fruits and vegetables; bread includes—bread, cake; cereals include—flour, cornmeal, rice, etc.

The percentages of the **$175 and over** income group were higher for the milk group and lower for the cereal group. This indicates that negro families on higher incomes were more likely to use larger quantities of milk than were those on lower incomes.

The average family used about 19 varieties of foods, including 4 vegetables and one fruit, during the study. This is less than the variety used by the average white family. As previously stated, there are a number of foods commonly used among whites which are seldom used among negroes. Practically, no difference was found in the variety of foods used by negroes in the low and high income groups. This means that an increase in income does not necessarily mean an increase in variety. When the white man's income increases, he increases variety, the negro increases quantity.

Environment and intelligence of the negro would account for this difference. O'Shea [43] has shown mental ability of negro pupils from large communities to be greater than mental ability of pupils in rural districts. It was observed that as environment and intelligence were improved, variety of food used increased. Menus of food served on the previous day were collected from all girls enrolled in the negro high schools of two large Delta towns 1|. Many of these students came from well-to-do and intelligent homes. Such menus compare favorably with those served in homes of intelligent white people.

1| Menus collected from Delta towns in which O'Shea conducted his study [43].

Menu served in the home of a carpenter's family

Breakfast	Dinner	Supper
Apple	Boiled Cabbage	Candied sweet potatoes
Biscuit	Potato Salad	Mashed Turnips
Hot tea	Cornbread	Cornbread
Fried Sausage	Peaches	Peach Pie
	Milk	Milk

Menu served in the home of a farmer's 1| family

Breakfast	Dinner	Supper
Grapefruit	Fried Corn	Fried Ham
Oatmeal	Baked Sweet Potatoes	Fried Eggs
Fried Eggs	Cornbread	Baker's bread
Toasted Bread	Butter Milk	Milk
Milk		

Lack of variety is not altogether the result of poor financial condition, but is more the result of ignorance. Therefore, it behooves those interested in improving the diet of the rural negro to teach him how to prepare all available foods in a wholesome and palatable manner. If he can once acquire a taste for these foods, then it will not be a difficult matter to get him to produce them.

MONEY VALUE OF EDIBLE FOOD WASTED

Edible food fed to animals was usually cheap food, such as buttermilk, skim-milk, cornbread, and biscuit. The value of this waste averaged about $2.00 a day, that is, less than 3 cents per family per day. This was much less than the value of waste in the study among white people.

SUMMARY

A summary of the data obtained from food consumption records for a period of one month from 80 negro families, 78 tenants and 2 renters, living in the Yazoo-Mississippi Delta follows:

(1) The average energy and nutritive value per man per day was low in all factors including the vitamins. Over 50 per cent of the families were 10 per cent or more below standard in protein, calcium, phosphorus, and iron. The dietaries were largely composed of cereals, fats, and sweets. Dietaries from the cash settlement type of plantation were somewhat more adequate than those from the supply settlement or the part cash and part supply settlement types.

(2) These dietaries offer one explanation for the high death rate, frequent illnesses, lack of energy, lowered resistance to infectious and contagious diseases, of negroes in Mississippi. They explain, at least in part, why pellagra occurs so frequently in the Delta counties and among negroes in particular.

(3) The menus submitted showed the need of an increased food

| Father is a renter. He moved to the city five years previous in order to give his children the advantages of a good education.

supply and a knowledge of how to combine and cook foods.

(4) Greatest food consumption was not always from families with greatest production, though families raising and selling large quantities of food consumed more than did families who neither raised nor sold food to any extent. Negroes are more apt to sell food raised on the farm than are white people.

(5) The average money value per man per day of the negro dietaries was 21 cents. 44 per cent of this money value was furnished by the farm.

(6) Inadequate income was partly responsible for low cost diets which were in turn partly responsible for poor diets. Increase in income of an ignorant negro generally means an increase in quantity but not necessarily an increase in variety of food. As environment and intelligence improve, variety of food used increases.

CONCLUSIONS AND RECOMMENDATIONS

Why should a people show signs of ailments that come from the need of a balanced ration, when facilities are so easily obtainable for producing this ration? Evidently, the majority have not yet adopted the slogan coined by Negro Extension Workers, "Take what you have and make what you can out of it."

It is, the school, the agricultural extension department, the public health department, and yes, even the church, that must teach and encourage these people, mothers and fathers, boys and girls to increase their food supply. This involves an increase in amount and quality of milk; improving the garden; raising, canning, and drying more vegetables; greater utilization of wild fruit; the development of fruit culture; increase in yield of eggs until the supply is great enough for family consumption and selling.

After they are taught to increase their food supply, they must be taught to combine and prepare this supply in a wholesome and time-saving manner.

Every effort should be furthered which will in any way bring about better physical and economic condition of the negro for unless this is done the average standard of public health for whites as well as for negroes will remain unsatisfactory.

All forces must combine in training the negro. Some one has well said, "The trained negro lives in better homes, wears better clothes, eats better food, does more efficient work, creates more wealth, rears his children more decently, makes a more decent citizen, and in time of race friction is always to be found on the side of law and order."

The Delta Home Demonstration agents, one of the main sources for this training, were asked the following question, "Do you think that there have been any changes in the food habits of the average negro family within the last few years?" One replied, "I can only speak for communities where Home Demonstration work is well established. There has been a wonderful change. More and better gardens are

grown, giving a greater supply of fresh vegetables. More chickens are raised. Instead of selling most of the chickens and eggs, these are used at home. Where cows can be kept on plantations, many families have them. Milk and butter are sold in exchange for vegetables to those who have no cows. A greater variety of vegetables is being produced. More care is being given to childrens' meals and school lunches."

Any educational work is slow at its very best. Let us hope that all forces will join hands and speed up this process of training so necessary to the physical and economic future of the colored race. Such united effort will result not only in improved conditions among the colored race, but improved conditions among the white race. Surely, this is a goal worth working for.

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Food and Health

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FOOD AND HEALTH

by

Dorothy Dickins

Someone has said, "The welfare of the nation, both physical and spiritual, is largely in the hands of those who provide the food". Then, the food we eat is of tremendous importance. Since this is true we ought to know more about it, and its effect on our health. A study for the purpose of finding out these facts was made in Mississippi during the year of 1926.

FOOD EATEN IN 75 MISSISSIPPI HOMES

The average quantity of food eaten by man in one day supplied satisfactory amounts of all fuel, all repairing, all regulating, all growth promoting, and all health giving substances with the exception of iron and vitamin C. Iron is necessary in formation of rich red blood, vitamin C in maintaining growth and health.

The small amount of green vegetables, fruits, meats, and whole grained foods used was the cause of the iron shortage. This should not have been true. Mississippi people can have these foods, for both soil and climate are favorable to their growth.

The shortage of vitamin C was principally due to the shortage of vegetables and fruits. Raw green cabbage, raw onions, canned and fresh tomatoes, raw peaches, rutabagas, and English peas are excellent sources of this vitamin. Many Mississippi people never eat raw cabbage. Many have not heard the slogan, "Have you had your tomato today?"

When we pass from the average quantity of food eaten by man in one day to the quantity which each man ate, we find a more serious situation. The majority were getting insufficient amounts of iron and vitamin C. Some were getting insufficient amounts of fuel foods, a few were getting insufficient amounts of calcium and phosphorus or bone forming foods. A number were getting insufficient amounts of protein or muscle building foods. Some were getting insufficient amounts of vitamin A and B which promote growth and health.

Milk has often been called "The Perfect Food". Of course, this is not exactly true, for "one can not live by milk alone". It is low in iron, which is necessary in formation of rich red blood. It does not furnish roughage enough to cause bowel movement. Yet, milk is our best food. It was generously used in these 75 Mississippi homes. This meant that the muscle building and bone forming demands were met.

Milk furnished a large part of the muscle supply. But for the use of milk, the diets of these people could be classed as belonging to the sweet, fat, and starch type, the type from which pellagra so frequently comes. But for milk, the muscle building supply would have been largely derived from vegetable sources. This would have meant a shortage in growth promoting material.

Milk is our best source of calcium, which is necessary for bone formation. In studying the effects of a diet poor in calcium, Voit kept a pigeon for a year on a low calcium diet. No bad effects were observed until the bird was killed and examined internally. Then a wasting way of the bones was observed.

Milk also furnished quantities of vitamins A and B. Butter, egg yolk, carrots, and green vegetables are good sources of vitamin A. Animals consuming food which contains little or no vitamin A develop a characteristic eye disease. Whereas, those consuming food which contains little or no vitamin B develop a disease of the nervous system. Vitamin B is more widely distributed in nature than is vitamin A. For this reason there is less apt to be a shortage. However, as long as we live on refined foods, vitamin B will be an important factor. Milk, eggs, whole grained foods, vegetables, and fruits are all good sources of vitamin B.

From this discussion it is readily seen what an important part milk played in the diets of these Mississippi farm families. Indeed, it did more than any other one food.

Why was so much milk used? Simply because 94% of the families enrolled had milk cows, and, as one farm woman put it, "We eat what we have". A close relation between consumption and production was found. If the farmer had no milk cow his family used little milk. It was found that the calcium content of dietaries of those families with a milk cow was about

twice that of those families without a milk cow. Indeed, a milk cow is the best provision for good bone formation, that a father can give his child. It is indeed fortunate that these Mississippi farmers owned milk cows.

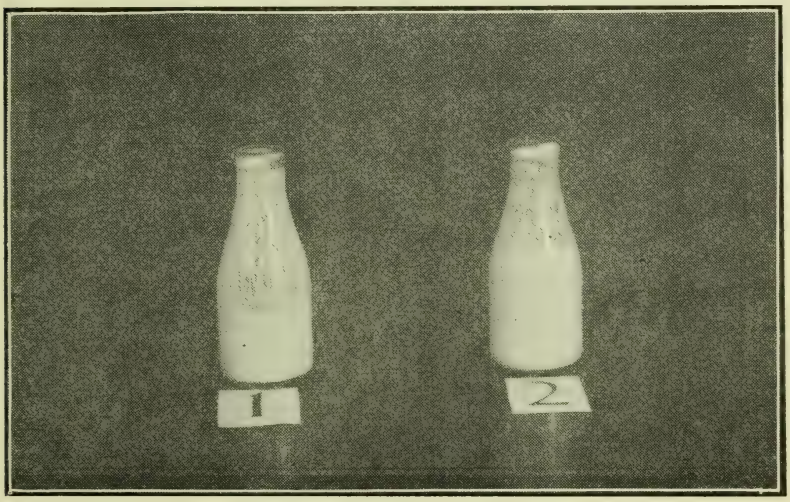

Fig. 1—A Milk cow means more milk: (1) milk used per man per day by families with no milk cows, (2) milk used per man per day by families with milk cows.

MEAT

On the whole these rural people were light meat eaters. Of course, there were families who used excessive quantities of meat. On the other hand, there were families who used meat scarcely at all. By meat, is not meant salt pork—but beef, poultry, pork, or organs of animals—that is, food largely composed of muscle rather than fat.

Liver was one of the neglected meats. It is a valuable source of iron, the nutritive factor which was provided in insufficient quantities. It should be used frequently.

Meat should be used at least on those days in which eggs are not used. One can, however, plan an adequate food supply using very little meat. In which case, care must be taken to provide right proportions of the other food groups. A limited meat supply without such provision was the cause of the iron deficiency.

Meat is one of our best muscle building foods. Milk, eggs, and cheese are also excellent muscle building foods. These foods are used in the body to repair parts which are being used up as well as for growth. If we eat more meat than is needed, the surplus decays in the bowels and makes poisons. This works the liver and kidneys too hard, because they are the parts of the body which have to get rid of these poisons. However, any housewife would do well to serve meat once a day, for it has been found in laboratory experiments on animals that meat, provided enough vitamins and calcium are present speeds up growth and reproduction and makes for optimum rearing of young.

EGGS

Nutrition authorities have set the standard at an egg per man per day. This is for the purpose of reinforcing the iron supply. The families included in this study used more than an egg per man per day in February and May but less than this amount in August and November. The general average for the study was slightly under the egg per man per day standard. If these people had stored away eggs when the supply was plentiful to furnish this standard when the supply was low, we could truthfully say that they had adopted the egg per man per day practice.

Eggs are more nearly inter-changeable with milk in nutritive value than is any other food. Egg yolk contains a good supply of iron in a form which is easily absorbed by the body. Eggs are especially rich in vitamin D. Diets poor in vitamin D may produce rickets, a disease in which the bones fail to develop as they should, with resulting deformities. Eggs probably furnished more of the food value in these dietaries than any other animal food with the exception of milk.

FRUITS AND VEGETABLES

These dietaries furnished just about a half of the fruit and vegetable requirement. Taking in consideration the nourishing substances lost in the cooking process the supply was less than half enough. If the supply of fruits and vegetables must be limited, then, those used should be prepared by methods which will save food value. However, a plentiful supply of fruits and vegetables is easily obtained by the Mississippi housewife.

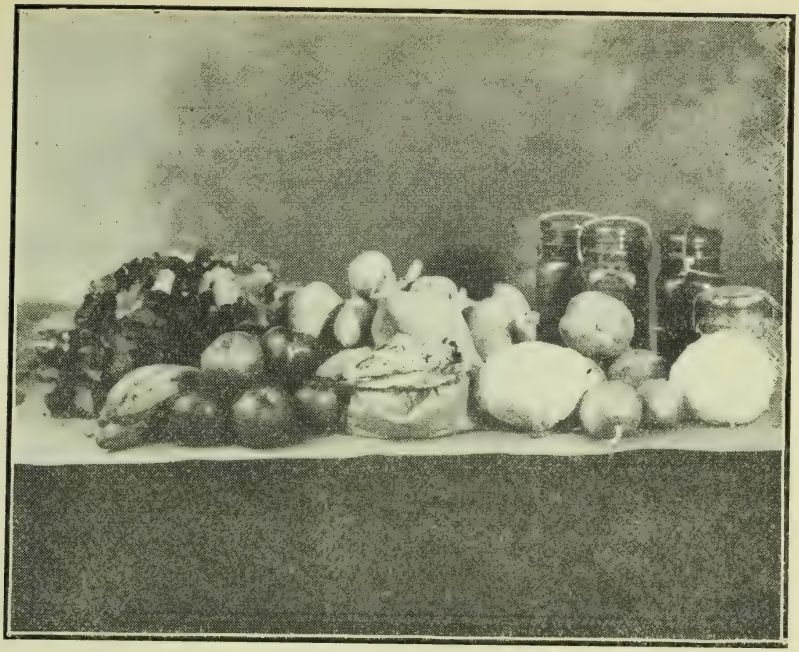

Fig. 2—The vegetable and fruit supply used by the average family during one week in November.

Fig. 3—A week's supply of vegetables and fruits for the average family. Combinations selected which can be easily procured in November.

A home in which a variety of five or six vegetables and two or three kinds of fruits are provided during a period of two weeks is generally a home providing inadequate amounts of these foods. The choice of fruits and vegetables used was good as far as it went. But many fruits and vegetables which could have easily been grown in Mississippi were not used at all. In a soil and a climate such as Mississippi has, fruits and vegetables can be obtained for the cultivating.

On the other hand, those families raising inadequate quantities could have purchased them. The average family usually has what they want from a car to a new dress for Sara. If they had really wanted an adequate fruit and vegetable supply they would have supplemented the supply raised at home by purchase.

This inadequate supply can be partly attributed to the fact that many do not realize the importance of these foods, and have made no effort to teach their children to eat them. Vegetables are disliked by many. Of all food classes, there were more dislikes in the vegetable group than in any other. 21 out of 548 people disliked all kinds of vegetables except potatoes. Of the vegetables commonly used in Mississippi cabbages and turnips were the ones most generally disliked. In many cases these dislikes were due to poor cooking. Home Demonstration Agents often tell of women who say they do not like cabbage. After a demonstration in the cookery of cabbage in which they taste a correctly cooked product the majority will exclaim, "Why, I like it cooked this way!"

What was the result of this low fruit and vegetable supply? The shortage of iron may be partly attributed to it. The shortage of vitamin C may be entirely attributed to it.

The green vegetable is perhaps the most important source of iron. The majority of families in this study did not receive enough iron in their food. A low iron supply will result in a deficiency of blood. Pale color of the linings of the lower eyelids, of the gums, and of the skin may be an indication of such a deficiency. It is significant that 8% of the children from families on diets with an adequate iron supply showed these symptoms, whereas 21% of the children from families on diets with a low iron supply showed these symptoms. The record of the latter group could probably have been improved by a more generous use of fruits and vegetables.

The vitamin C supply, as well as the iron supply, is generally low in diets providing as small quantities of fruits and vegetables as did the diets of these Mississippi people. The supply of vitamin C was probably adequate during watermelon, tomato, and peach season but inadequate during late fall, winter, and early spring. Neither did collards, turnip greens, and cabbage, nor onions and lettuce used at this time supply adequate quantities of vitamin C. In the former group, the method of cooking used destroyed perhaps 95% of the vitamin C content. In the latter group, too small amounts were used to yield adequate quantities of this vitamin.

Raw fruits and vegetables and canned tomatoes are our best sources of vitamin C. As these foods were used in such small amounts during the greater part of the year, it is evident that inadequate quantities were provided. The average amount of canned tomatoes used per family for a period of two weeks was: 3.08 pounds in February; 1.32 pounds in May; .26 pounds in August; and 4.28 pounds in November. The longer the time from tomato season, the smaller the quantity of canned tomatoes used. This indicates an inadequate canning budget.

Among the more noticeable symptoms shown by guinea pigs fed on diets adequate in every respect but in vitamin C are stiffness of joints and soreness of gums, leading to looseness and loss of teeth. Some authors applying this to human nutrition suggest that the use of diets poor in vitamin C may be a factor in tooth decay. Others claim that the so-called rheumatism which afflicts such a large proportion of our people in winter and spring is due at least in part to the use of diets poor in vitamin C. It is at least interesting to note that 50% of the children had one or more decayed teeth. That 20% of the adults suffered from rheumatism.

It has also been suggested that diets low in vitamin C result in lessened resistance to disease. About 50% of the children suffered from infectious disease during the year of the study. About 30% had frequent colds.

Of course, it is impossible to tell whether these conditions have been brought about by diets low in vitamin C. It seems probable, however, that a diet poor in vitamin C was at least one of the factors.

In addition to being a good source of iron and vitamin C, fruit and vegetables have mild laxative properties. This is due

to their high water content, the action of certain salts of organic acids, and their bulk. With a low fruit and vegetable supply, is there any wonder that one third of the adults enrolled in this study suffered from constipation? The generous use of fruits and vegetables would have protected many of these adults against this most common of ills, constipation.

The remedy for such a shortage is an all-year-round garden an up-to-date orchard, and a bountiful food preservation budget. The remedy is simple, but getting it carried out is the difficult thing.

Conserving what one has is the keynote of economy. As has been previously stated, it is possible to lose much of the food value in preparation and cookery. More fruits and vegetables should have been served raw. The water in which the vegetable was cooked should have been eaten.

If the housewives enrolled in this study had used the Food Habits Score Card sent out by the Extension Department in planning meals their diet would have provided adequate quantities of fruits and vegetables as well as other foods.

Score Card For 4-H Club Members

Food Requirements per Child per Day	Score	Days of Week						
		M	T	W	T	F	S	S
	Percent							
Milk								
1 cup 10								
2 cups 15	20							
3 or 4 cups 20								
Vegetables								
1 serving 10								
2 servings 5								
Potatoes may be included as one of the above servings.	20							
Leafy vegetables, extra credit 5								
Fruits								
1 serving 10								
2 servings 15	20							
Raw fruit or canned tomatoes, extra credit 5								
Whole Grain Products								
1 serving 10	15							
2 servings 15								
Cheese, Eggs, Meat, Dried beans, or Peas								
1 serving of any one 10	15							
1 serving of any two 15								
Water (total liquid)								
4 glasses 5	10							
6 glasses 10								
Total credits	100							
Deductions:								
Use of tea or coffee 10								
Eating sweets between meals 10								
Total Deductions								
Total Score								
Weekly Average								

This score card emphasizes the need of certain essential foods in a well selected diet. It must be supplemented by bread and butter and moderate amounts of fats, sweets, and starchy foods. Growing boys and girls need an ample food supply, for exercise as well as for growth. The size of the servings should vary according to the need of the person, but the average serving of vegetables, fruits, and cereals, is from one-half to three-fourths of a cup.

SWEETS

Sweets are one of our fuel foods. Because they have an attractive flavor and are cheap, they are often used too freely in economical diets. In this study the average amount used was not excessive. There were, however, a number of families who used too many sweets. When used in generous quantities they often displace fruit, which is valuable for its iron and vitamin supply. Sweet foods are likely to overstimulate love of flavor and cut down the appetite for mildly flavored foods as milk, grain foods, and eggs.

Pure cane molasses is one of our best sweets, for it supplies calcium and iron as well as energy. Since the iron supply, provided in this study, was low, it is well that molasses was substituted for part of the sugar. Sugar is solely a fuel food.

CEREALS

Cereals or grain foods are also classed as fuel foods. Low cost dietaries usually contain a quantity of cereal foods. The amount used by these 75 Mississippi farm families was about the same amount which has been suggested by a well known authority. This was not true of the kind used.

In dietaries as low cost as these, the use of whole grained instead of the refined products is important. Yet, very little whole grained cereal was used. The cereals eaten were for the most part flour and cornmeal with bran and germ removed, that is, cereals which had been refined. White flour was eaten in larger quantities than was cornmeal. This was due to the fact that biscuits were usually served at breakfast and supper, cornbread at dinner. These families did not average a pound of baker's bread a week.

Whole grained cereals are body regulators and body builders as well as fuel providers. Yet, whole grained cereals such

as, whole wheat flour and oatmeal were used scarcely at all by these Mississippi families. This would not have made much difference if these families had been well provided with fruits and vegetables. The use of these foods was limited. As long as this was true, part of the refined supply should have been replaced by the whole grained product.

FATS

Fats are also fuel foods. Mississippi people like fats and use them excessively in cooking. Many believe that people in warm climates require more fat. This seems improbable for fats are heat producing as well as work producing foods. The generous use of fats in the diet is probably due to custom or habit. Quantities of lard, butter, and salt pork were eaten by these 75 farm families.

USE OF BEVERAGES AND SEASONINGS

A record was not kept of those products having no food value—such as coffee, tea, pepper, vinegar, and spices. Information was, however, obtained concerning their general use.

It was found that though coffee was used in a large number of homes it was used by few children in these homes. One rarely finds a family drinking large quantities of milk and large quantities of coffee as well. Many of these families drank large pitchers of milk at each meal.

Tea was used regularly in very few homes. Iced tea is used very generously by town people, especially in summer months. Its use was negligible among these rural people. Very few purchased ice as it is expensive and troublesome to bring home. The majority consider it a luxury, especially as its season comes in a time when money is scarce. The fact that milk is kept cool in an artesian well or a cistern means that milk consumption is high even in summer months.

Black pepper was the most generally used seasoning. It was used daily in practically all the homes. The use of spices, mustard, and flavorings was not great.

METHODS OF PREPARATION AND COOKERY

A well balanced meal can be planned. Yet, unless the foods making up this meal taste good, a number of foods will not be eaten. Unless correct methods of preparation and cookery are

used, much of the food value will be lost. Indeed, it is often best not to cook at all. For instance, Mrs. Morris has not provided her family with a generous supply of vitamin C. She has three pounds of cabbage on hand. In this case, it would be advisable for her to serve cold slaw rather than boiled cabbage.

Variety in selection of foods, as well as variety in methods of preparation, is necessary. For example, many of the housewives limited their choice of vegetables to five or six. Many used only one method in preparing these. Monotony is not conducive to getting foods eaten. Thus, methods of preparation and cookery have much to do with whether an adequate diet is eaten or not.

61% of the families included in this study preferred eggs fried, 42% fruit in pies, 53% fruit fresh, 83% meat fried, 95% vegetables cooked with salt pork. From this summary it is easily seen why so much fat is used. It is well that the majority prefer their fruit raw. What a pity it is that fresh fruit cannot be obtained from the Mississippi farm throughout the year as can fresh vegetables.

Vegetables are perhaps the most poorly prepared of foods. They must look well and taste well to be eaten. It seems probable that one reason for the small amount used is due to dislikes caused by poor cooking. By poor cooking, it is possible to ruin the appearance and taste of a vegetable as well as lose most of the food value. The majority of Mississippi housewives boil green vegetables for two hours. Pot liquor from these vegetables is consumed in about 50% of the homes. Such foods as cabbage develop a strong flavor and odor and become indigestible on long cooking. Over-cooking not only spoils the taste of the vegetables but destroys some of the vitamin content. This is especially true of vitamin C which is easily destroyed by ordinary cooking.

In the cooking process minerals as well as vitamins are dissolved into the cooking water. If this water is not consumed much of the food value will be lost. Thus, it would seem advisable to cook the meat first in a small amount of water, add the vegetables just in time to become thoroughly tender before serving, and serve at once. In this way, one would get a good tasting product, a product in which food value had been saved.

Conservation of food value and better preparation of food are equally as important as an adequate supply. The Mississippi

housewife needs to pay more attention to the use she makes of the foods which she procures for her family.

FOOD COMBINATIONS

The housewife was not asked to keep a record of menus served. A good idea of food combinations can, however, be obtained from food consumption and cookery records. Such data, combined with a knowledge of home conditions of families enrolled, make it possible to approximate menus served. With such an idea in mind, menus served for one week in November by the average housewife have been worked out. These are to be compared with well balanced menus which could have been served.

Typical November Menus Served by Families in Study

Breakfast	Sunday Dinner	Supper
Salt pork	Chicken	Cold chicken
Fried sweet potatoes	Dressing	Dressing
Gravy	Rice	Candied sweet potatoes
Muffins	Gravy	Jelly
Butter	Candied sweet potatoes	Biscuit
Molasses	Macaroni and cheese	Milk
Milk	Jelly	
Coffee	Biscuit	
	Lemon pie	
	Milk	

Breakfast	Monday Dinner	Supper
Sausage	Field peas (dry)	Fried sweet potatoes
Fried sweet potatoes	Stewed tomatoes	Biscuit
Biscuit	Baked sweet potatoes	Butter
Butter	Cornbread	Molasses
Molasses	Biscuit	Milk
Milk	Butter	
Coffee	Molasses	
	Milk	

Breakfast	Tuesday Dinner	Supper
Grits and gravy	Boiled cabbage	Salt pork
Batter cakes	Creamed Irish potatoes	Rice
Butter	Cornbread	Gravy
Molasses	Sweet potato pie	Biscuit
Milk	Biscuit	Butter
Coffee	Butter	Molasses
	Milk	Milk

Typical November Menus Which Could Have Easily Been Served by Families in Study

Breakfast	Sunday Dinner	Supper
Baked apples	Chicken	Peanut butter sandwiches
Salt pork	Dressing	Pear salad
Hominy	Gravy	Biscuit
Whole wheat muffins	Candied sweet potatoes	Butter
Butter	Buttered beets	Milk
Milk	Jelly	
Coffee	Biscuit	
	Lemon pie	
	Milk	

Breakfast	Monday Dinner	Supper
Quince sauce	Field peas (dry)	Scrambled eggs
Chicken hash	Stewed tomatoes	Creamed Irish potatoes
Rice	Baked sweet potatoes	Whole wheat muffins
Biscuit	Kraut	Grapes
Butter	Corn sticks	Butter
Milk	Peaches and cream	Milk
Coffee	Milk	

Breakfast	Tuesday Dinner	Supper
Apples (fresh)	Roast pork	Salt pork
Cream of Wheat	Candied sweet potatoes	Grits
Biscuit	Cold slaw	Gravy
Butter	Buttered carrots	Canned tomatoes
Molasses	Baked pears	Corn muffins
Milk	Biscuit	Butter
Coffee	Butter	Molasses
	Milk	Milk

Wednesday

Breakfast	Dinner	Supper
Oatmeal	Field peas (dry)	Salt pork
Batter cakes	Baked sweet potatoes	Rice
Butter	Cornbread	Gravy
Molasses	Cake and sauce	Fig preserves
Milk	Butter	Cake
Coffee	Milk	Biscuit
		Butter
		Milk

Thursday

Breakfast	Dinner	Supper
Fried Irish potatoes	Turnips and greens	Fried eggs
Biscuit	Baked sweet potatoes	Fried sweet potatoes
Butter	Cornbread	Biscuit
Molasses	Peach cobbler	Peach cobbler
Milk	Butter	Butter
Coffee	Milk	Molasses
		Milk

Friday

Breakfast	Dinner	Supper
Fried sweet potatoes	Turnip and greens	Fried eggs
Biscuit	Field peas (dry)	Fried sweet potatoes
Butter	Baked sweet potatoes	Gravy
Molasses	Cornbread	Biscuit
Milk	Biscuit	Butter
Coffee	Butter	Peach preserves
	Molasses	Milk
	Milk	

Saturday

Breakfast	Dinner	Supper
Rice	Canned string beans	Salmon
Gravy	Baked sweet potatoes	Fried Irish potatoes
Biscuit	Cornbread	Biscuit
Butter	Apple pie	Butter
Molasses	Butter	Molasses
Milk	Milk	Milk
Coffee		

Wednesday

Breakfast	Dinner	Supper
Canned plums	Roast beef	Cream of tomato soup
Oatmeal	Creamed Irish potatoes	Whole wheat biscuit
Salt pork	Collards	Butter
Biscuit	Cornbread	Fig preserves
Molasses	Cake and sauce	Milk
Milk	Milk	
Coffee		

Thursday

Breakfast	Dinner	Supper
Baked pears	Sausage	Macaroni and cheese
Oatmeal	Turnips and greens	Biscuit
Poached eggs on toast	Baked sweet potatoes	Peach salad
Milk	Cornbread	Butter
Coffee	Butter	Milk
	Blackberry pie	
	Milk	

Friday

Breakfast	Dinner	Supper
Cream of Wheat with prunes	Beef stew with carrots onions and potatoes	Egg omelet
Cornmeal griddle cakes	Tomato salad	English peas
Butter	Cornbread	Whole wheat muffins
Molasses	Apple float with cream	Peach preserves
Milk	Cake	Butter
Coffee	Biscuit	Milk
	Butter	
	Milk	

Saturday

Breakfast	Dinner	Supper
Bananas	Fresh butter beans	Scalloped salmon
Oatmeal	Boiled cabbage	Baked Irish potatoes
Scrambled eggs	Corn muffins	Lettuce salad
Toasted biscuit	Sweet potato custard with meringue	Biscuit
Butter	Butter	Molasses
Milk	Milk	Milk

These menus indicate that the use of fruits, vegetables, whole grained cereals, and meat is much more limited than it should be. Fruit and vegetable charts from the Mississippi Extension Department show that it is possible to have three varieties of fresh fruits and twenty-five varieties of fresh vegetables in November.

There are few Mississippi farmers who can not afford to substitute a portion of their cereal supply for whole grained cereals and who can not provide meat at least on those days when eggs are not served.

It is difficult to produce a varied and adequate diet from a food supply provided by the hit and miss method. It is difficult to produce varied and adequate menus when menu planning is done several minutes before the meal is to be prepared.

An adequate supply depends on a food preservation budget which will supplement products obtained from the garden, orchard, and poultry flock. Planning such a supply takes careful thought on the part of the housewife. Of course, planning the supply is only the beginning, but it is a step equally as important as producing the supply.

With an adequate and varied supply of food on hand it should be an easy task to plan the menus. A definite time should be set aside each week for meal planning, just as a definite time is set aside for darning. Surely providing an adequate food supply is of as much importance as keeping stockings in repair. It is difficult to plan adequate and varied meals at the last minute. In fact, monotony is generally due to last minute meal planning. On short notice one generally thinks only of the same old thing in the same old way. Several hours each week spent in meal planning would probably do more than any other one thing to improve the Mississippi dietary.

RELATION OF FOOD EATEN TO HEALTH

This food study was conducted in two soil areas of Mississippi, the Brown Loam and the Short Leaf Pine. The people living in the Brown Loam area used more muscle building and bone forming foods. Then if diet really matters the health condition of the people from this area should be better.

PHYSICAL CONDITION OF CHILDREN FROM THE TWO AREAS

The children in the Brown Loam area averaged 6.4 physical defects, while those in the Short Leaf Pine area averaged 7.1 physical defects. The physical defects occuring more frequently among the Short Leaf Pine children can be grouped under two headings: (1) Nutritional—as, lines under eyes, flabby muscles, underweight; (2) Postural—as, a stoop, similar to that which results from muscular weakness in old age, round shoulders, flat chest, flaring ribs, flat feet, and evidence of rickets. It is significant that these are among the defects in which inadequate diet plays a part.

One would then, naturally expect the more poorly fed group, the group with more physical defects, to be more susceptible to disease. This was the case. The children from the Short Leaf Pine area were ill a greater number of days during the year. More was spent on drugs than was spent for the children of the Brown Loam area.

The average gain in height and weight was greater for the group having fewer physical defects and illnesses.

These differences cannot, of course, be entirely attributed to diet, but diet is doubtless one of the factors.

DOES DIET MATTER?

Mrs. Randle, one of the members of this study had three children, a boy twelve years old, and two girls, one five years old, the other one year old. She provided her family with an adequate diet. Yet her children had more physical defects than did any children on adequate diets. The boy had 9 defects, whereas, the five year old girl had 6 defects and the one year old girl 7 defects.

On the other hand, Mrs. Didly's children, on an extremely poor diet had nearly twice as many defects. Her nine year old boy had 14 defects, her eleven year old girl 14 defects, and her six year old girl 13 defects. Mrs. Didly's children not only had more physical defects than did Mrs. Randle's but they had defects of a more serious type. This agrees with findings for the entire study—which means that the child generally pays for a poor diet during childhood.

Fig. 4—Three National Health Winners from Mississippi. Wholesome food played an important part in making these girls physically fit.

On the other hand the ill effects of an inadequate diet do not always show themselves immediately or in striking ways. In fact, there were a few children from families on poor diets in excellent physical condition. Mrs. Josey, for instance, provided her family with a very inadequate food supply. Yet, her 17 year old son did not have a physical defect. Such exceptions as these cause the casual observer to say, "What one eats doesn't matter. Look how sickly Johnny is, and he's fed right by the book". Many children survive simply because of careful feeding. Many middle aged people suffer because of poor feeding in childhood.

That a diet inadequate in kind or amount generally results either directly or indirectly in a greater number or physical defects, increased susceptibility to disease, and retarded growth, is a fact of vital importance. It, therefore, behooves every housewife interested in the welfare of her family to see that an adequate, well cooked food supply is provided and consumed.

Bulletin 256 July 1928

PROGRESS REPORT

ON

Cost of Production Route in Jones County, Mississippi, 1927

By

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And

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PROGRESS REPORT

ON

Cost of Production Route in Jones County, Mississippi, 1927

This report covers the first year's work in Jones County—Bulletins 228, 237 and 243 of this station give comparable data for Choctaw County. Nineteen farmers completed the year's records, the results of which are here given 1|. The Jones County data are applicable especially to the Long Leaf Pine Section of South Mississippi whereas the Choctaw county data are applicable especially to the Short Leaf Pine section of Northeast Mississippi.

Jones County is located in the east central part of the Long Leaf Pine section. On the farms studied, Ruston Fine Sandy Loam soils predominated with Orangeburg soils ranking second. The average annual rainfall is about 55 inches, distributed as follows: Winter, 16 inches; Spring, 14 inches; Summer, 16 inches; and Fall, 9 inches.

The farmers of Jones County have for a number of years recognized the value of properly terracing cultivated land, and practically all fields on the farms studied were terraced. A rather broad base terrace is used and the crest is usually planted to crops. Liberal amounts of fertilizer were used generally but in some cases better results would probably have been obtained if a fertilizer with a different chemical formula had been used.

Climatic conditions for the year of the study were comparatively favorable, and yields for most crops were perhaps a little above what could usually be expected. Most of the farm work was done by the operator and his family. A few farmers had share croppers, who, with very few exceptions, were white. There were very few negroes in the community. Complete records were not kept on the share croppers' operations.

A number of the cooperating farmers added to their income by doing work off the farm during times when there was little to do at home.

The farms of the study are numbered from 1 to 19 in this report. The same number applies to the same farm throughout, al-

1| The farmers who cooperated in the study and to whom we are grateful were: T. A. Blackledge, J. J. Breazeale, B. S. Crosby, Van Ellzey, L. L. Folks, A. B. Graham, V. G. Hinton, Van Jordan, R. M. Keith, E. J. Lott, John Odom, W. E. Odom, A. E. Patrick, S. W. Rainey J. S. Stringer, A. W. Tisdale, C. B. Walters, E. M. Watkins, and L. W. Windham.

though different tables are arrayed on different bases. Table 1 is arrayed on the basis of percent return on investment. It was used in assigning the number designations.

The study is being continued through the year 1928.

Statements in regard to production methods are based partly on Experiment Station data and partly upon results of this study. For greater elaboration of experimental results a list of bulletins, which may be obtained free, may be found in the back of this report.

Table 1

Financial Statement
Arrayed on Percent Return on Investment
19 Farms, Jones County, Miss.—1927

Farm No.	Total Investment	Crop and Livestock Receipts	Miscellaneous Receipts 1/	Increase in Inventory	Value Items Furnished the Home	Total Value of Products
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
1	3041	1181.86	622.51	754.40	319.58	2878.35
2	2865	418.72	880.75	737.49	412.76	2449.72
3	11281	2324.73	515.55	870.80	567.62	4278.70
4	7863	1749.52	5.10	697.59	480.07	2932.28
5	10594	653.49	72.00	2344.90	222.48	3292.87
6	6480	1117.57	1215.70	787.50	450.35	3571.12
7	3270	1364.38	7.50	19.20	349.75	1740.83
8	8100	1254.03	227.82	600.55	521.51	2603.91
9	7763	1218.44	115.51	302.24	611.23	2247.42
10	8928	2025.40	39.00	———	696.22	2760.68
11	3879	836.90	280.69	———	327.14	1444.73
12	3532	606.77	306.60	245.80	465.04	1624.21
13	6535	1491.57	825.45	831.56	387.53	3536.11
14	3242	753.35	102.70	58.91	605.05	1520.01
15	7852	1041.55	191.00	———	468.90	1701.45
16	3379	694.38	118.10	———	300.48	1112.96
17	5707	734.51	80.62	———	420.62	1235.75
18	3055	966.55	75.00	———	393.91	1435.46
19	12325	2272.65	84.64	2771.78	762.89	5891.91
Aver.	6299	1195.08	303.48	580.14	461.22	2539.92

1/ Includes Labor off the Farm.

Table 1—Continued

Cash Expenses	Decrease in Inventory	Value of Family Labor 2|	Total Charge	Farm Income	Value of Operator's Labor	Return on Investment 3|
Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Percent
1241.90	———	———	1241.90	1636.45	329.79	43.0
1001.51	———	64.35	1065.86	1383.86	262.95	39.1
1553.54	———	176.35	1729.89	2548.81	256.46	20.3
1132.38	———	51.30	1183.68	1748.60	227.40	19.3
1052.24	———	179.10	1231.34	2061.53	157.50	18.0
2145.66	———	17.55	2163.21	1407.91	336.82	16.5
673.68	———	335.10	1008.78	732.05	233.32	15.3
1008.94	———	47.02	1055.96	1547.95	353.17	14.8
603.36	———	426.10	1029.46	1217.96	288.00	12.0
1035.64	158.40	302.55	1496.59	1264.09	253.20	11.3
497.88	54.53	123.00	675.41	769.32	374.55	10.2
984.97	———	20.25	1005.22	618.99	267.98	9.9
2409.52	———	194.10	2603.62	932.49	320.55	9.4
303.68	———	469.91	773.59	746.42	449.48	9.2
272.63	218.85	290.55	782.03	919.42	264.71	8.3
422.27	10.40	176.55	609.22	503.74	335.55	5.0
525.86	6.27	67.20	599.33	636.42	370.50	4.7
642.65	229.85	134.40	1006.90	428.56	363.45	2.1
5259.94	———	223.20	5483.14	408.77	303.22	.9
1198.33	35.70	173.61	1407.64	1132.28	302.56	13.17 4|

2| Contains board furnished hired labor, household goods sold, and other items contributed to the farm by the home.

3| The difference between farm income and value of operator's labor multiplied by 100, and the result divided by Total Investment.

4| Average weighted.

The income from farming, like that from other forms of business, is made up of the returns for labor, use of land, use of other capital, and managing ability. The return on investment as shown in Table 1 may be considered as land rent, interest on other capital invested and profit resulting from management, since 15 cents per hour has been charged off for labor. The return on the total investment on these farms ranged from .9 to 43.0 percent. If we take 5 per cent for use of land and 6 per cent for use of other capital, the percentages used in the calculations for crop and livestock enterprise tables of this report, 10 farms, or over half, made a profit on the business. That is the operators on 10 of the 19 farms received wages of 15 cents per hour, rent amounting to 5 per cent on the market value of the land, interest on other capital invested at 6 per cent and an additional amount varying from .3 to 32.0 percent on total investment for the management of the operations. The average return for the management when calculated on this basis was 2.2 percent. Good management consists

in so using the labor, land and capital such as cash, livestock, machinery, feed, seed, fertilizer, etc., that the whole taken together will result in good net returns.

Any farmer may prepare a financial statement of his business for comparison with the figures here shown, by using such records as he has and his best estimates where the actual figures are not available.

Such a comparison should show where the business is weak and where it is strong so that an intelligent effort may be made to make the weak parts strong and the strong parts stronger. The tables that follow show the approximate costs of producing the several farm products and the crop yields and livestock production obtained.

Table 2—Cotton—Cost per Acre and per Pound Lint
Arrayed on Cost of Producing Lint
19 Farms—Jones County, Miss., 1927

Farm No.	Acres Per Farm	Man Labor	Horse Work	Fertilizers	Other Costs [1]	Gross Costs [2]	Seed Credit	Net Cost	Yield Lint	Cost Per Pound
	No.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Pounds	Cents
3	8.1	22.76	6.16	5.08	8.31	42.31	16.81	25.50	519	4.91
4	12.3	11.18	4.64	6.95	5.09	27.86	9.56	18.30	335	5.46
5	29.3	12.12	3.46	8.79	5.68	30.05	11.45	18.60	333	5.59
1	10.5	15.21	4.26	4.49	6.53	30.49	9.41	21.08	300	7.03
6	12.2	12.85	4.67	5.69	5.94	29.15	8.02	21.13	284	7.44
8	13.4	15.10	5.31	2.48	7.29 [3]	30.18	8.11	22.07	283	7.80
9	16.9	19.96	5.96	2.02	4.68	32.62	9.57	23.05	278	8.29
19	18.6	17.58	5.76	7.15	4.80	35.29	8.34	26.95	325	8.29
10	29.2	21.10	9.09	6.07	6.97	43.23	9.16	34.07	369	9.23
13	9.8	15.74	5.24	3.16	4.99	29.13	5.82	23.31	252	9.25
2	9.9	15.35	7.74	5.55	5.09	33.73	7.01	26.72	266	10.04
11	9.6	27.57	6.64	5.58	7.01	46.80	11.31	35.49	331	10.72
17	8.5	22.6	8.46	6.22	7.40	44.76	10.06	34.70	311	11.16
15	17.2	18.87	10.49	——	5.06	34.42	6.74	27.68	234	11.84
12	11.8	12.08	6.76	2.98	4.02	25.84	4.63	21.21	167	12.70
7	22.9	17.18	6.54	4.45	4.46	32.63	4.71	27.92	219	12.75
18	8.3	33.34	10.60	15.26	7.04	66.24	8.35	57.89	418	13.85
16	13.2	22.42	4.46	5.50	4.40	36.78	6.09	30.69	216	14.21
14	11.0	25.44	7.39	4.94	6.57	44.34	5.84	38.50	262	14.69
					Weighted Average					
	14.2	18.17	6.44	5.36	5.73	35.70	8.40	27.30	298	9.17

1| Includes seed, ginning, use of horse tools (2 cents per hour), tractor (28 cents per hour), and truck (25 cents per hour.)

2| Exclusive of charge for use of land.

3| Contains $1.86 for tenant's equity after crop was planted.

Table 2 shows the values of the items making up the cost of producing cotton, and the cost per pound of producing lint. All man labor was valued at 15 cents per hour so that a higher cost in this

column indicates a larger amount of labor. Horse work was valued at actual cost; so that a high cost per acre may mean either a large amount of horse work or a high cost rate. Table 18 shows the costs per hour of horse work for each farm.

The outstanding factor in the cost per pound of lint is the yield per acre. It is worthy of note that the producer having the lowest cost also had the highest acre yield. As a rule, high lint yields are accompanied by high seed yields so that the seed credit is also greater. The Mississippi Experiment Stations advocate thick spacing and a liberal use of a well balanced fertilizer as essential to high yields in the Long Leaf Pine section of the state. Thick spacing was the general practice on the cooperating farms. The kinds and amounts of fertilizer used are shown in Table 5.

The U. S. Department of Agriculture gives the average yield of lint per acre in Mississippi, crop of 1927, as 192 pounds and the December 1 farm price as 20.5 cents per pound.

Table 3—Cotton—Man Labor per Acre by Operations
Arrayed on Cost of Producing Lint
19 Farms—Jones County, Mississippi—1927

Farm No.	Acres Per Farm	Land Preparation	Haul & Apply Fert.	Harrow And Plant	Cultivate	Hoe And Chop	Pick	Haul To Gin	Total	Yield Lint
	No.	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Pounds
3	8.1	11.2	2.5	5.0	19.8	27.0	83.0	3.0	151.5	519
4	12.3	5.6	4.4	3.6	10.4	12.9	33.6	4.0	74.5	335
5	29.3	1.0	1.3	3.0	9.9	9.9	54.6	1.1	80.8	333
1	10.5	6.9	3.0	2.8	15.0	5.1	64.3	4.3	101.4	300
6	12.2	7.1	5.2	4.0	15.3	11.6	39.3	3.2	85.7	284
8	13.4	6.4	2.9	5.5	18.2	17.0	44.1	6.6	100.7	283
9	16.9	2.0	1.0	2.2	24.7	30.9	71.4	.9	133.1	278
19	18.6	8.9	2.1	4.2	20.3	14.7	65.8	1.2	117.2	325
10	29.2	4.6	6.2	2.6	15.4	11.9	95.9	4.1	140.7	369
13	9.8	7.2	6.2	5.9	16.0	5.8	55.4	8.4	104.9	252
2	9.9	5.6	2.7	2.6	17.7	12.0	59.2	2.5	102.3	266
11	9.6	9.4	8.7	4.2	19.9	25.0	112.2	4.4	183.8	331
17	8.5	9.2	11.7	5.9	28.8	19.2	71.8	4.6	151.2	311
15	17.2	8.1	——	4.6	22.8	35.6	50.6	4.1	125.8	234
12	11.8	4.9	1.5	4.5	19.4	12.8	35.7	1.7	80.5	167
7	22.9	10.3	3.0	3.6	13.9	24.5	55.4	3.8	114.5	219
18	8.3	13.2	12.0	6.0	25.3	34.9	122.5	8.4	222.3	418
16	13.2	16.1	4.5	4.6	19.8	16.2	86.4	1.9	149.5	216
14	11.0	23.9	4.2	4.0	35.3	26.0	72.0	4.2	169.6	262
					Weighted Average					
	14.3	7.6	3.9	3.9	18.2	18.1	66.0	3.4	121.1	298

The operations performed and the time required, for producing an acre of cotton vary widely from farm to farm and from season to season. Table 3 shows the time expended on the different operations by the 19 cooperators. The data in Table 3 shows in part why some

costs were lower than others. For instance: farms 3 and 4 both produced cotton at a very low cost, but farm 3 expended more than twice as much labor per acre. Soil type, weed infestation, stand, seasonal conditions, equipment used, amount of fertilizer used, time of performing the operations, distance from gin and market, varieties grown, and yield, each have their influence on the amount of labor necessary to handle the crop. These factors may operate either directly or indirectly. For example: adding fertilizer requires time for hauling and distributing; it may make hoeing more necessary; and by increasing the yield, it increases the picking and hauling labor and the ginning charge. On the other hand, it results in the larger yield, thus reducing the total tillage labor per pound of cotton. In making the crop, the farmer should weigh carefully all the factors, and adopt those methods which he believes to be best for his conditions. He may plant a small acreage, fertilize and tend well, or he may plant a larger acreage use less fertilizer and less intensive methods in cultivation. He may use 1-horse or two-horse implements. He may plant thin and take a chance on missing a stand or he may plant thick and chop to a stand. He may plant on grass infested land or shift his cotton to cleaner fields. He has a wide choice of varieties to select from which vary as to yield, length of staple, earliness, proportion of lint to seed, size of boll, and ease of picking. In making his decisions, he needs all knowledge on the subject that he can get. In addition to his own experience and that of his neighbors, the results of experiments made by the state experiment station are available. The publications listed in the back of this report are worth studying in this connection.

Table 4—Cotton—Horse work per acre by operations and Power Machinery use—All operations
Arrayed on Cost of Producing Lint
19 Farms—Jones County, Mississippi.—1927

Farm No.	Acres Per Farm	Land Preparation	Haul & apply Fert.	Harrow and Plant	Cultivate	Haul To Gin	Total Horse Work	Truck & Trac. Use 1|	Yield Lint
	No.	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Pounds
3	8.1	17.3	2.5	5.0	21.6	——	46.4	3.0 t	519
4	12.3	7.6	3.3	3.6	10.4	8.0	32.9	——	335
5	29.3	——	.7	3.0	11.1	2.1	16.9	.7 T	333
1	10.5	13.2	.8	2.8	15.0	——	31.8	4.3 t	300
6	12.2	7.8	3.8	4.0	15.3	——	30.9	3.2 t	284
8	13.4	8.7	3.7	5.5	18.2	13.1	49.2	——	283
9	16.9	2.9	1.4	2.2	24.7	——	31.2	.9 t	278
19	18.6	14.1	2.1	4.2	20.3	2.0	42.7	——	325
10	29.2	3.3	3.7	2.1	15.5	8.2	32.8	2.5 T	369
13	9.8	11.9	6.8	5.9	16.0	14.6	55.2	——	252
2	9.9	11.2	1.7	2.6	17.7	——	33.2	2.5 t	266
11	9.6	9.4	5.5	4.2	19.9	4.4	43.4	——	331
17	8.5	17.3	8.2	7.0	28.8	3.3	64.6	2.9 t	311
15	17.2	11.6	—	4.6	21.6	3.5	41.3	.6 t	234
12	11.8	6.5	.8	5.3	19.4	3.4	35.4	——	167
7	22.9	14.6	.5	3.6	13.9	2.2	54.8	2.7 t	219
18	8.3	26.4	9.6	6.0	25.3	16.8	84.1	——	418
16	13.2	16.5	—	4.6	19.8	——	40.9	1.9 t	216
14	11.0	32.3	2.9	4.0	35.3	7.6	82.1	——	262
				Weighted Average				1.0 t	
	14.3	10.5	2.6	3.9	18.3	4.4	39.7	.3 T	298

1|T—tractor; t—truck.

Table 4 shows the horse work used per acre on cotton. As with man labor it varies widely and for the same reasons. In some cases the amount of horse work was reduced by using tractors and trucks. The economy of this may be questioned in some cases. It will be discussed at more length under table 26 dealing with the cost of operating autos and trucks.

The amount of horse work necessary for cotton production depends largely on the type of soil, weed infestation, seasonal conditions and kind of machinery employed. More power is required to cultivate heavy soils than is needed on the lighter sandy types. Various methods of handling the crop are used, and there are possibilities for better distribution of the season's horse work by thorough preparation of the seed bed when work is not pressing so that cultivation will be facilitated at a season when there is much to be done.

Table 5—Cotton—Seed, and Kinds and Amounts of Fertilizer per Acre Arrayed on Cost of Producing Lint
19 Farms—Jones County, Miss.—1927

Farm No.	Acres per Farm	Seed	Fertilizers						Yield Lint
			Super-Phosphate	Nitrate of Soda	Cotton seed meal	Mixed	Other	Manure	
	No.	Bush.	Pounds	Pounds	Pounds	Pounds	Pounds	Tons	Pounds
3	8.1	1.0	198	99	——	——	99 1|	——	519
4	12.3	.6	200	——	100	——	125 2|	——	335
5	29.3	1.4	——	309	——	——	——	——	333
1	10.5	1.1	59	——	29	190a	——	——	300
6	12.2	1.2	74	41	——	246b	——	——	284
8	13.4	1.0	298	——	——	——	——	——	283
9	16.9	1.2	237	——	——	——	——	——	278
19	18.6	1.2	5	——	——	431b	——	——	325
10	29.2	2.6	257	137	——	——	34 1|	——	369
13	9.8	.9	132	49	20	——	20 3|	——	252
2	9.9	1.8	202	——	——	202c	——	——	266
11	9.6	2.1	208	135	——	——	——	——	331
17	8.5	2.1	259	——	189	——	——	.59	311
15	17.2	1.4	——	——	——	——	——	——	234
12	11.8	1.4	221	——	68	——	25 1|	——	167
7	22.9	.9	64	——	11	192b	——	.26	219
18	8.3	2.3	192	120	36	360d	30 3|	——	418
16	13.2	1.1	91	——	——	250b	——	——	216
14	11.0	1.8	186	——	186	——	——	——	262
			Weighted Average						
	14.3	1.4	138	63	25	94	15	.04	298

a—Formula 12-4-4
b—Formula 8-4-4
c—Formula 10-5-3
d—Formula 10-5-5
1| Kainit.
2| Calcium Cyanamid.
3| Muriate of Potash.

The soils of the Long Leaf Pine section are relatively poor in their natural state, but few soils respond more readily to the intelligent application of fertilizers. Table 5 can not be taken as a test of the relative merits of the different formulas used because of the difference in soils and management. For results of fertilizer tests, consult the list of bulletins in the back of this report. Fertilizer tests at the Poplarville Station indicate that an application of 600 pounds of an 8-4-4 mixture is about right for the most profitable results generally. The formula for some of the applications shown in Table 5 may be readily calculated. For instance: Farm 3 used a total of 397 pounds per acre consisting of 198 pounds 18 per cent Super-phosphate, 99 pounds 15 per cent Nitrate of Soda, and 99 pounds 12 per cent Kainit. The plant

food elements in the 397 pounds of mixture would be: phosphorus, 35.64 pounds (198x.18); nitrogen, 14.85 pounds (99x.15); and potash, 11.88 pounds (99x.12). Dividing these amounts by the hundreds and fractions of hundreds in the total amount or 3.97 hundreds, we get the formula 9-4-3 to nearest whole numbers. In like manner, the calculation for Farm 12 shows the approximate formula 13-1-1 where the average formula 2.5-6.5-1.7 is used for cotton seed meal in the mixture.

Profits from the use of fertilizer may depend as much on the formula and availability as upon the amount used. If an element is not needed, it is wasteful to apply it. Where quick action is wanted, an morganic fertilizer gives best results. Cotton seed meal, while a good fertilizer, is slow acting. Only when it is relatively cheap should it form a part of the fertilizer for cotton. It is usually more economical to feed the meal to cows and save the manure or use the meal under feed and forage crops where quick growth is not an essential factor.

Where considerable fertilizer is used, savings may be realized by mixing at home rather than purchasing mixed goods. The relative merits of home mixed and factory mixed fertilizers of like formula has been found to be about equal. The difficulty has been to obtain factory mixed goods containing sufficient nitrogen to properly balance the phosphorus content. The cost of nitrogen is more than that of an equal amount of phosphorus so that fertilizers with the higher nitrogen content are higher priced. Farmers, not knowing the value of more nitrogen have demanded the low nitrogen formulas because they were cheaper, and manufacturers have met the demand. Formulas containing a higher percentage of nitrogen are now coming on the market so that those who desire ready mixed fertilizers containing a higher percentage of nitrogen should be able to have their wants supplied.

Table 5 also shows the amounts of seed used. In this connection it is well to stress the point that one of the first essentials for a good yield is a good stand. Seed is relatively cheap and such as is not needed for a stand has some fertility value. The average planted per acre is perhaps sufficient for sandy soils, but 2 bushels has been advocated by successful growers on the stiffer soils which are inclined to crust over after rains. Sufficient seed are able with their combined force to break the crust and produce a stand where insufficient seed may necessitate replanting. An abundance of seed is especially necessary when the planting season is unfavorable.

Table 6—Corn—Cost per Acre and per Bushel
Arrayed on Cost of Producing Grain
19 Farms—Jones County, Miss.—1927

Farm No.	Acres per Farm	Man Labor	Horse Work	Fertilizers	Other Costs 1|	Gross Cost 2|	Fodder Credit	Net Cost	Yield Per Acre	Cost per Bush.
	No.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Bush.	Dol.
2	4.5	5.74	9.39	5.48	.92	21.53	.49	21.04	41.8	.50
4	9.9	6.58	5.26	2.00	.90	14.74	——	14.74	28.8	.51
6	4.1	9.07	6.15	8.72	2.15	26.09	——	26.09	51.0	.51
19	14.4	8.38	6.75	3.56	1.10	19.79	——	19.79	37.8	.52
1	5.4	7.10	6.16	——	1.75	15.01	——	15.01	27.8	.54
14	13.6	6.82	3.39	.58	.90	11.69	.08	11.61	21.7	.54
15	13.9	3.88	5.21	——	.52	9.61	1.54	8.07	14.2	.57
10	9.5	5.32	6.45	——	2.79	14.56	——	14.56	24.2	.60
17	10.5	6.92	5.45	1.39	.93	14.69	——	14.69	24.3	.60
9	24.0	4.86	4.72	2.93	.58	13.09	——	13.09	19.7	.66
3	3.3	8.86	6.49	4.90	1.13	21.38	——	21.38	32.0	.69
18	3.9	11.95	10.45	6.57	1.79	30.76	——	30.76	38.6	.80
8	11.6	5.71	3.84	3.83	.80	14.18	——	14.18	17.4	.81
16	9.2	4.05	2.28	1.94	.69	8.96	——	8.96	11.0	.81
5	12.1	2.82	2.58	8.31	.33	14.04	——	14.04	16.5	.85
12	6.0	9.87	11.94	5.93	1.42	29.16	——	29.16	28.6	1.02
13	16.2	7.68	4.62	2.67	1.06	16.03	——	16.03	13.9	1.15
11	6.4	7.14	5.26	1.47	.77	14.64	——	14.64	11.7	1.25
7	7.3	8.18	12.22	2.10	1.51	24.01	——	24.01	17.2	1.40
					Weighted Average					
	9.8	6.34	5.54	2.86	1.01	15.75	.13 3|	15.62	22.5	.69

1| Seed and machinery use charge.

2| Exclusive of Land use Charge.

3| Harvested fodder. Stalkfield pasture was charged to livestock but was not credited here.

The corn crop ranked next to cotton in importance on the farms studied. Much that has been said in regard to the cotton crop applies equally in the economical production of corn, the itemized cost of which is shown in Table 6. The table shows that costs per bushel tended to decrease as yields per acre increased, a fact generally recognized by farmers. Yields per acre on these farms were considerably above the state average of 17.8 bushels as given by the United States Department of Agriculture. The average farm price per bushel December 1, from the same source was 93 cents. At this price, a yield of about 17 bushels per acre is enough to return 15 cents per hour for man labor and pay all expenses, exclusive of land rent. The average of 22.5 bushels on the farms studied allows 5.5 bushels worth at 93 cents per bushel, $5.11 for the use of the land. Where a yield of 22.5 bushels per acre can be obtained, corn is evidently a profitable secondary crop for the community, but it should be remembered that even though the yield is lower and the cost greater, it is better where time and means

are available to grow corn if there is no better paying enterprise. While it may not show a profit or even pay expenses it may serve to reduce expenses and increase the net income for the farm as a whole.

It is worthy of note that farm 6 which had the highest yield also had the largest expenditure for fertilizer. However, fertilizer in itself is no guarantee of a good yield as is shown by farm 5 which expended the next highest amount on this item. With corn, as with other enterprises the most profitable results are obtained with that nice balance of land, labor, and capital represented largely by fertilizer, which just provide enough of each so that the most economical production will be obtained. This requires close study and careful management.

Table 7—Corn—Man Labor per Acre by Operations Arrayed on Cost of Producing Grain
19 Farms—Jones Co., Miss.—1927

Farm No.	Acres per Farm	Land Preparation	Haul & Apply Fert.	Horrow and Plant	Cultivate	Hoe	Pull and Haul	Total	Yield
	No.	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Bush.
2	4.5	8.8	2.4	3.8	14.1	1.1	8.1	38.3	41.8
4	9.9	9.2	3.0	5.1	10.3	2.7	13.6	43.9	28.8
6	4.1	12.5	8.1	1.9	14.9	——	23.1	60.5	51.0
19	14.4	15.3	1.4	2.8	14.6	6.8	15.0	55.9	37.8
1	5.4	8.3	1.3	3.8	16.5	——	17.4	47.3	27.8
14	13.6	3.3	1.5	2.5	23.2	6.9	8.1	45.5	21.7
15	13.9	4.7	——	1.8	8.3	3.6	7.5	25.9	14.2
10	9.5	8.9	——	4.8	7.7	——	14.1	35.5	24.2
17	10.5	11.4	4.7	2.9	13.4	2.7	11.0	46.1	24.3
9	24.0	3.1	.9	1.0	17.4	5.8	4.2	32.4	19.7
3	3.3	11.2	4.5	4.2	10.3	10.6	18.3	59.1	32.0
18	3.9	15.2	7.3	5.0	23.6	10.2	18.4	79.7	38.6
8	11.6	8.5	2.6	2.7	11.1	3.1	10.8	38.1	17.4
16	9.2	8.4	3.3	2.0	7.9	——	5.4	27.0	11.0
5	12.1	.8	3.3	2.7	5.4	2.5	4.1	18.8	16.5
12	6.0	17.7	1.4	1.6	25.2	3.9	16.0	65.8	28.6
13	16.2	14.9	5.5	2.8	13.1	8.7	6.2	51.2	13.9
11	6.4	12.1	3.2	3.6	14.7	7.8	6.2	47.6	11.7
7	7.3	25.4	1.9	2.2	11.0	4.4	9.6	54.5	17.2
					Weighted Average				
	9.8	9.2	2.5	2.7	13.6	4.5	9.7	42.2	22.5

Table 8—Corn—Horse Work per Acre by Operations and Tractor Use —all Operations
Arrayed on Cost of Producing Grain
19 Farms—Jones Co., Miss.—1927

Farm No.	Acres Per Farm	Land Prepa-ration	Haul & Apply Fert.	Harrow and Plant	Culti-vate	Pull and Haul	Total Horse Work	Trac. Use	Yield per Acre
	No.	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Bush.
2	4.5	17.6	——	3.8	14.1	4.8	40.3	——	41.8
4	9.9	16.9	1.0	5.1	10.3	4.0	37.3	——	28.8
6	4.1	9.5	3.2	1.9	14.9	11.2	40.7	3.7	51.0
19	14.4	26.5	——	2.8	14.6	6.1	50.0	——	37.8
1	5.4	16.7	.7	3.8	16.5	9.3	46.0	——	27.8
14	13.6	6.0	2.0	2.0	23.4	4.3	37.7	——	21.7
15	13.9	6.5	——	.7	8.3	5.0	20.5	——	14.2
10	9.5	2.5	——	3.8	7.7	9.3	23.3	8.1	24.2
17	10.5	18.6	1.9	2.9	13.4	4.8	41.6	——	24.3
9	24.0	5.1	——	.5	17.4	1.7	24.7	——	19.7
3	3.3	20.3	——	6.0	10.3	12.2	48.8	——	32.0
18	3.9	30.4	9.6	10.1	23.6	9.2	82.9	——	38.6
8	11.6	14.0	2.6	2.7	11.1	5.2	35.6	——	17.4
16	9.2	8.4	——	2.0	7.9	2.2	20.5	——	11.0
5	12.1	1.6	——	2.7	5.8	2.5	12.6	——	16.5
12	6.0	25.4	——	1.8	27.1	8.4	62.5	——	28.6
13	16.2	25.7	5.0	2.8	13.1	2.0	48.6	——	13.9
11	6.4	12.1	.9	3.6	14.7	3.1	34.4	——	11.7
7	7.3	48.1	1.0	2.2	11.0	2.7	65.0	——	17.2
				Weighted Average					
	9.8	14.6	1.3	2.6	13.7	4.6	36.8	.5	22.5

Man labor and horse work are usually the largest items of expense in corn production. Any saving of these items, therefore, which is consistent with good tillage tends to reduce costs. One has a choice of many implements differing in size and kind with which to work as well as different sizes and kinds of power units.

Thought should be given the several operations to determine whether it is being done in a manner to yield the greatest net return. The two outstanding considerations will be the quality of work done and the time required to do it. It may be advisable to make some sacrifice in the one in favor of the other. One man might cultivate one acre with a hoe, 20 acres with one mule and the necessary implements or 40 acres with two mules and 2-mule implements. Usually, when land is scarce, much man labor is used per acre, while where land is plentiful, less man labor and more mules and implements are used. The possibility of using larger teams and implements in the Long Leaf Pine section is worthy of serious study by the farmers. While some quality in the work may be sacrificed, the additional amount of land which one man could handle might more than make up for it. The point to guard against in changing to larger teams and implements is the

wasting of the time saved. Any time saved on one farm enterprise must be used on some other enterprise if the change is to result in financial gain. Otherwise, the only return for the additional outlay in mules and equipment will be more leisure time.

Table 9—Corn—Seed, and Kinds and Amounts of Fertilizer per Acre Arrayed on Cost of Producing Grain
19 Farms—Jones Co., Miss.—1927

Farm No.	Acres per Farm	Seed	Fertilizers					Yield per Acre
			Super-phos.	Nitrate of Soda	C. S. Meal	Other	Manure	
	No.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Tons	Bush.
2	4.5	7.9	——	110	——	132a	——	41.8
4	9.9	11.0	70	——	70	11b	——	28.8
6	4.1	8.8	171	244	24	——	——	51.0
19	14.4	7.5	——	125	——	——	——	37.8
1	5.4	13.3	——	——	——	——	——	27.8
14	13.6	10.6	——	——	——	——	.30	21.7
15	13.9	7.8	——	——	——	——	——	14.2
10	9.5	3.8	——	——	——	——	——	24.2
17	10.5	6.9	72	——	19	——	.20	24.3
9	24.0	6.0	200	42	——	——	——	19.7
3	3.3	10.9	182	121	——	——	——	32.0
18	3.9	9.0	102	178	38	——	——	38.6
8	11.6	6.2	65	——	194	——	——	17.4
16	9.2	4.3	141	——	——	22a	——	11.6
5	12.1	5.9	52	244	63	——	——	16.5
12	6.0	12.0	202	90	118	——	——	28.6
13	16.2	6.7	111	——	111	——	——	13.9
11	6.4	5.6	16	47	——	——	——	11.7
7	7.3	14.8	88	——	88	——	——	17.2
			Weighted Average					
	9.8	7.8	77	49	39	5	.03	22.5

a—Formula 8-4-4.
b—Calcium Cyanamid.

Table 9 shows the amount of seed and the kinds and amounts of fertilizer per acre used on corn by the nineteen cooperators. The liberal applications of fertilizer made by these farmers doubtless accounts in a large part for the better than state average yields. While corn does not respond to fertilizer as readily as does cotton, yet some fertilizer on most farms is essential for good yields. The fact that some good yields were obtained without the use of fertilizer should not be taken to indicate that this item can be dispensed with generally. These yields were made on bottom lands or on lands which had been highly fertilized in previous years and which contained considerable amounts of residual fertility. As a rule, fertilizers containing a liberal amount of nitrogen give best results with corn. Quick acting fertilizers are not so essential for corn as they are for cotton so that such materials as cotton seed

meal and barn yard manure are excellent for this crop. As with cotton, however, it is usually more profitable, when cotton seed meal is high, to feed it to cattle and carefully save the manure for the land.

Table 10—Hay—Cost Per Acre and Per Ton
Arrayed on Costs Per Ton
16 Crops—Jones Co., Miss.—1927

Farm No.	Acres Per Farm	Man Labor	Horse Work	Fertilizer	Other Cost 1|	Gross Costs 2|	Seed Credits	Net Costs	Yield per Acre	Cost per Ton
	No.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Tons	Dol.
C. Pea Hay										
5	3.0	6.33	3.38	.63	2.71	13.05	7.92	5.13	.66	7.77
9	3.9	3.27	3.72	——	2.45	9.44	3.08	6.36	.77	8.26
14	2.3	17.48	4.08	——	3.47	25.03	12.17	12.86	1.09	11.80
17	3.8	9.72	7.00	——	3.67	20.39	——	20.39	1.48	13.78
Wt. Av	3.3	8.39	4.67	.15	3.05	16.26	4.90	11.36	1.00	11.26
Soy Bean Hay										
16	2.0	6.15	2.56	——	1.72	10.43	——	10.43	1.50	6.95
12	1.1	5.38	9.72	2.21	2.32	19.63	——	19.63	1.75	11.21
5	3.2	4.35	2.54	.60	3.07	10.56	——	10.56	.70	15.08
19	2.5	8.10	7.60	3.65	2.52	21.87	——	21.87	1.39	15.73
18	1.1	15.00	13.77	——	8.56	37.33	——	37.33	1.18	31.64
Wt. Av	2.0	6.92	5.86	1.37	3.16	17.31	——	17.31	1.21	14.33
Oat Hay										
19	4.4	1.73	2.47	——	1.74	5.94	——	5.94	.46	12.91
3	5.0	2.13	3.38	——	1.91	7.42	——	7.42	.40	18.55
13	5.5	3.70	2.68	2.01	2.74	11.13	——	11.13	.44	25.30
17	5.2	3.94	4.64	.65	1.99	11.22	——	11.22	.29	38.69
Wt. Av	5.0	2.94	3.32	.72	2.12	9.10	——	9.10	.39	23.12
Mixed Hay										
1	4.0a	3.16	2.68	——	1.71	7.55	——	7.55	1.30	5.81
8	7.1b	5.74	3.94	——	6.07	15.75	——	15.75	.92	17.12
13	11.0a	3.75	4.03	——	3.48	11.26	——	11.26	.31	36.32
Wt. Av	7.4	4.29	3.76	——	3.98	12.03	——	12.03	.68	17.57
All Hay Wt. Av	4.1	5.10	4.13	.46	3.09	12.78	.98	11.80	.74	15.95

1\| Seed and Machinery use charge.

2\| Exclusive of land use charge.

a—Cowpeas and soy beans.

b—Cowpeas and sorghum.

Table 10 shows the cost figures for growing and harvesting hay. The wide variation in the cost of the items as well as in the yields per acre indicates that there is little uniformity in production methods for hay in the community. Records were kept on sixteen crops of four different kinds; a very few farms did not attempt to produce hay. A few crops were total failures, and some farms produced and kept records on more than one type of hay crop. The principal value of the table lies in showing the possibilities for hay production in the section.

Where a choice lies between growing rough feed or grain feed on

the farm, and the feed to be purchased is shipped in, it is usually more economical to grow the rough feed and purchase the grain since handling charges are greater per unit of feed value on the rough feed because of its bulky nature.

While some of the costs per ton appear high, consideration should be given to certain unmeasurable credits which are not shown. With legume crops, there is the element of soil fertility conservation while with oats there is conservation of fertility in the prevention of washing and leaching and the pasture value.

Cow peas showed a lower average cost per ton largely, but not wholly, because of the seed credit. Soy beans are a newer crop for the section and their possibilities are largely undeveloped. Some failures with this crop may have been due to the absence of the nodule-forming bacteria in the soil as some varieties seem to require inoculation of the soil more than others.

One advantage of these hay crops, of which the farmers availed themselves, was the possibility of preceding or following them with some other short-season crop thus getting double duty from the land.

Since ample provision for rough feed is a first requisite for the successful keeping of livestock, and livestock are valuable in economically maintaining soil fertility, serious study may well be given the subject of how best to handle the hay enterprise on the farms of this section. It is worthy of note that 12 of the 16 crops were produced at a cost of less than twenty dollars per ton which was about the average price per ton of purchased hay in the community.

Table 11—Hay—Man Labor per Acre by Operations Arrayed on Costs per Ton

16 Crops—Jones Co., Miss.—1927

Farm No.	Acres per Farm	Land Prepa-ration	Plant	Ferti-lize	Culti-vate	Harvest	Haul	Total Labor	Yield per Acre
Cow Pea Hay	No.	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Tons
5	3.0	7.6	8.2	——	3.3	23.1	1|	42.2	.66
9	3.9	15.4	1.5	——	2|	3.4	1.5	21.8	.77
14	2.3	19.1	6.5	——	4.3	73.6	13.0	116.5	1.09
17	3.8	6.5	8.3	——	2|	50.0	1|	64.8	1.48
Wt. Av	3.3	11.6	6.0	——	1.5	34.0	2.8	55.9	1.01
Soy Bean Hay									
16	2.0	6.5	3.0	——	4.0	27.5	1|	41.0	1.50
12	1.1	8.8	3.5	2.6	3.5	17.5	1|	35.9	1.75
5	3.2	6.2	3.1	.9	3.1	15.7	1|	29.0	.70
19	2.5	9.9	6.8	2.0	7.5	7.2	20.6	54.0	1.39
18	1.1	11.3	13.2	——	22.6	52.8	1|	99.9	1.18
Wt. Av	2.0	8.1	5.1	1.1	6.6	20.0	5.2	46.1	1.21
Oat Hay									
19	4.4	8.0	1.1	——	——	2.3	1|	11.4	.46
3	5.0	10.0	1.0	——	——	3.2	1|	14.2	.40
13	5.5	10.0	.9	.7	——	13.1	1|	24.7	.44
17	5.2	13.4	3.5	.9	——	8.5	1|	26.3	.29
Wt. Av	5.0	10.5	1.6	.4	——	7.1	——	19.6	.39
Mixed Hay									
1	4.0a	2.2	3.3	——	.6	15.0	1|	21.1	1.30
8	7.1b	8.5	3.5	——	——	19.9 3|	6.4	38.3	.92
13	11.0a	12.2	2.6	——	——	3.9	6.3	25.0	.31
Wt. Av	7.4	9.3	3.0	——	.1	11.0	5.2	28.6	.68
All Hay Wt. Av	4.1	9.9	3.5	.3	1.4	15.8	3.1	34.0	.74

1\| Included with harvesting.

2\| Crop was broadcast.

3\| Includes baling.

a—Cowpeas and soy beans.

b—Cowpeas and sorghum.

Table 12—Hay—Horse Work per Acre by Operations and Tractor Use—All Operations Arrayed on Costs per Ton
16 Crops—Jones Co., Miss.—1927

Farm No.	Acres Per Farm	Land Preparation	Plant	Cultivate	Harvest	Haul	Total Horse Work	Tractor Use	Yield Per A.
C. Pea Hay	No.	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Tons
5	3.0	5.0	8.2	3.3	——	——	19.1	2.6	.66
9	3.9	10.3	1.5	1|	6.6	1.1	19.5	——	.77
14	2.3	16.7	2|	4.3	13.9	10.4	45.3	——	1.09
17	3.8	5.5	8.3	1|	39.6	3|	53.4	——	1.48
Wt. Av	3.3	8.8	4.8	1.5	21.5	2.1	38.7	.6	1.01
Soy Bean Hay									
16	2.0	6.5	3.0	4.0	10.0	3|	23.5	——	1.50
12	1.1	8.8	3.5	3.5	35.1	3|	50.9	——	1.75
5	3.2	——	3.1	3.1	6.2	3|	12.4	6.2	.70
19	2.5	9.9	8.8 4|	7.5	7.9	22.2	56.3	——	1.39
18	1.1	22.6	26.4	22.6	37.7	3|	109.3	——	1.18
Wt. Av	2.0	7.3	7.0	6.5	14.1	5.6	40.5	2.0	1.21
Oat Hay									
19	4.4	18.3	2|	——	——	——	18.3	2.3	.46
3	5.0	19.0	2|	——	6.4	3|	25.4	——	.40
13	5.5	21.7	2|	——	6.5	3|	28.2	——	.44
17	5.2	26.9	1.2	——	7.3	3|	35.4	——	.29
Wt. Av	5.0	21.6	.3	——	5.3	——	27.2	.5	.39
Mixed Hay									
1	4.0a	2.2	2.8	——	15.0	3|	20.0	——	1.30
8	7.1b	13.1	1.4	——	14.9 5|	7.1	36.5	——	.92
13	11.0a	24.5	3.4	——	7.2	7.3	42.4	——	.30
Wt. Av	7.4	16.8	2.6	——	11.1	6.0	36.5	——	.68
All Ha Wt. Av	4.1	15.3	3.0	1.3	11.8	3.3	34.7	.6	.74

1| Crop was broadcast.
2| Included wtih land preparation.
3| Included with harvesting.
4| Contains 2 hours for distributing fertilizer.
5| Includes baling. .
a—Cowpeas and soy beans.
b—Cowpeas and sorghum.

Tables 11 and 12 show the man labor and horse work on hay crops. The discussion of these items in connection with cotton and corn applies largely to hay also. Two crops of peas, all oats and some of the mixed hay crops were sown broad cast. The other crops were planted in rows. These data do not show that one method is superior to the other with the legume crops. Each method may have its advantages and disadvantages depending on the condition of soil, weed infestation, facilities for seeding and handling and utilization of the crop.

Considerable hand work was done in harvesting the hay crop. With small irregular and only partially cleared fields such as were used in a number of cases, this is about the only possible method. The small acreages would not justify the purchase of harvesting equipment by an individual farmer unless he was able to do considerable custom work in addition to harvesting his own crop even if the fields were ideal for the successful operation of modern equipment. Where fields do permit the use of modern machinery, the cooperative ownership of such machines might prove to be economical.

Table 13—Sweet Potatoes—Cost per Acre and per Bushel Arrayed on Cost per Bushel
9 Crops—Jones Co., Miss.—1927

Farm No.	Acres per Farm	Man Labor	Horse Work	Fertilizer	Other Costs 1|	Total Cost 2|	Yield per Acre	Cost per Bush.
	No.	Dol.	Dol.	Dol.	Dol.	Dol.	Bush.	Dol.
11	.9	15.83	6.79	1.83	5.33	29.78	147	.20
14	2.1	25.60	4.02	3.20	3.27	36.09	167	.22
2	.4	8.92	12.21	9.29	8.19	38.61	167	.23
18	.6	22.62	17.30	5.76	6.99	52.67	169	.31
12	.5	13.80	30.18	7.84	13.16	64.98	200	.32
1	.9	15.50	9.53	5.91	6.97	37.91	111	.34
8	.7	34.41	9.37	.62	9.14	53.54	147	.36
17	.3	43.13	16.14	3.14	9.60	72.01	143	.50
3	1.0	14.25	7.18	——	6.08	27.51	50	.55
				Weighted Average				
	.8	21.13	9.60	3.54	6.38	40.65	141	.29

1\| Seed and machinery use charge.
2\| Exclusive of land use charge.

Some sweet potatoes were grown on each of the cooperating farms, but only nine farms kept sufficiently complete records of this crop to permit summarizing. Table 13 shows the costs of the several items expended and the costs per acre and per bushel. The latter costs are at the farm. In calculating the relative profitableness of the crop, the cost of delivering to market should be added.

The average yield per acre for the state was 112 bushels and the average December 1 farm price was 80 cents as estimated by the U. S. Department of Agriculture. Some of the cooperators sold potatoes for more than the above price and some sold for less depending on whether sales were made on the street or to a canning plant of the section. It seems that, where costs and yields are in line with the average for the nine crops, a small acreage of sweet potatoes is a desirable enterprise. However, where a canning plant market is not available, a supply greater than local needs making curing, storing and distant marketing necessary brings about an entirely new problem. In such a case costs of curing, storing, shipping and losses incident thereto should be considered together with the probable price in the distant market.

Table 14—Sweet Potatoes—Man Labor and Horse Work by Operations Arrayed on Cost per Bushel
9 Crops—Jones Co., Miss.—1927

Man Labor per Acre

Farm No.	Acres per Farm	Bed Seed	Land Preparation	Apply Fert.	Transplant	Cult. and Hoe	Dig	Total	Yield Per A.
	No.	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Bush.
11	.9	1|	11.1	6.7	2|	32.2	55.5	105.5	147
14	2.1	14.0	19.5	2.4	32.4	38.1	64.3	170.7	167
2	.4	1|	9.5	2.4	4.8	11.9	30.9	59.5	167
18	.6	1|	33.9	1.7	22.0	5.1	88.1	150.8	169
12	.5	1|	14.0	2.0	4.0	12.0	60.0	92.0	200
1	.9	5.5	14.5	6.7	8.9	4.4	63.3	103.3	111
8	.7	7.4	10.3	——	33.8	29.4	148.5	229.4	147
17	.3	1|	28.6	10.7	14.3	19.6	214.3	287.5	143
3	1.0	1|	10.0	4.0	27.0	9.0	45.0	95.0	50
					Weighted Average				
	.8	5.3	16.3	3.7	19.9	21.9	73.7	140.8	141

Horse Work per Acre

11	.9	——	11.1	6.7	——	15.5	11.1	44.4	147
14	2.1	1.9	13.8	——	——	21.4	7.6	44.7	167
2	.4	——	9.5	2.4	——	11.9	28.6	52.4	167
18	.6	——	61.0	——	——	5.1	71.2	137.3	169
12	.5	——	26.0	——	——	12.0	120.0	158.0	200
1	.9	——	6.7	——	——	4.4	60.0	71.1	111
8	.7	——	11.8	——	——	13.2	61.8	86.8	147
17	.3	——	28.6	——	——	8.9	85.7	123.7	143
3	1.0	——	20.0	——	——	4.0	30.0	54.0	50
					Weighted Average				
	.8	.5	18.2	.8		12.6	39.4	71.5	141

1| Included with land preparation.
2| Included in cultivating.

Table 14 shows the man labor and horse work on nine crops of sweet potatoes. Here, as on other crops, it is worth while to study each operation and perform it in the most economical manner consistent with the results expected. Where potatoes are grown for outside markets, grading and packing constitute additional labor and the yield of marketable potatoes would be somewhat below that shown in the table.

Table 15—Sugar Cane—Cost per Acre and per Gallon Syrup Arrayed on Costs per Gallon Syrup
6 Crops—Jones Co., Miss.—1927

Farm No.	Acres per Farm	Man Labor	Horse Work	Fertilizer	Other Costs 1/	Gross Costs 2/	Seed Cane Credit	Net Cost	Yield Per Acre	Cost per Gal.
	No.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Gal.	Dol.
9	.9	17.11	12.87	1.85	23.07	54.90	40.76	14.14	65	.22
1	.4	81.75	32.49	13.50	92.35	220.09	97.50	122.59	250	.49
17	.2	82.86	33.06	4.19	57.70	171.81	28.57	143.24	209	.68
10	1.5	25.80	12.74	4.00	8.78	51.32	3.00	48.32	70	.69
12	.2	42.49	16.98	11.34	71.23	142.04	33.34	108.70	128	.85
14	.1	112.50	33.75	13.25	153.90	313.40	——	313.40	310	1.01
Weighted Average										
	.55	37.29	17.31	5.24	33.36	93.20	28.10	65.10	110	.59

1/ Seed cane and machinery use charge.
2/ Exclusive of land use charge.

Table 16—Sugar Cane—Man Labor, Horse Work, and Use of Truck Arrayed on Cost per Gallon of Syrup
6 Crops—Jones Co., Miss.—1927

Man Labor per Acre

Farm No.	Acres per Farm	Land Preparation	Plant	Apply Fertilizer	Cult. and Hoe	Strip	Haul	Make Syrup	Total Labor	Yield per A.
	No.	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Gal.
9	.9	5.4	4.3	2.2	35.9	32.6	10.9	22.8	114.1	65
1	.4	22.5	32.5	17.5	65.0	207.5	100.0	100.0	545.0	250
17	.2	71.4	95.3	23.8	61.9	119.0	85.7	95.3	552.4	209
10	1.5	8.0	6.7	5.3	9.3	58.0	36.7	48.0	172.0	70
12	.2	5.5	2.8	2.8	22.2	111.1	55.5	85.3	283.3	128
14	.1	40.0	20.0	25.0	185.0	180.0	100.0	200.0	750.0	310
Weighted Average										
	.55	13.9	14.9	7.5	32.8	79.5	43.2	56.8	248.6	110

Horse Work per Acre

Farm No.	Acres per Farm	Land Preparation	Plant	Apply Fertilizer	Cultivate	Haul		Make Syrup	Total Horse Work	Yield Per A.
						Horses	Truck			
	No.	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Gal.
9	.9	10.9	8.7	——	3.3	21.7	——	22.8	67.4	65
1	.4	45.0	25.0	12.5	60.0	——	50.0	100.0	242.5	250
17	.2	47.6	47.6	——	61.9	——	38.1	95.3	252.4	209
10	1.5	5.3	2.7	5.3	3.3	14.7	——	14.7	46.0	70
12	.2	11.1	1/	——	22.2	——	55.6	55.6	88.9	128
14	.1	40.0	20.0	——	95.0	100.0	——	120.0	375.0	310
Weighted Average										
	.55	15.7	10.3	3.9	17.7	15.7	11.5	37.7	101.0	110

1/ Included in land preparation.

Tables 15 and 16 show the costs and the man labor and horse work by operations for six crops of sugar cane. This is a crop calling for rather intensive culture and the acre costs are relatively high, but as the product has a high unit value, it was, in five of the six cases, a profitable enterprise on these farms.

The average yield for the state was 185 gallons per acre and the December 1 price was 95 cents as estimated by the U. S. Department of Agriculture. The state yield is somewhat above that shown for the cooperating farms, but had no seed cane been saved on the farms studied, their yield would have averaged considerably higher.

Some syrup was sold locally, usually at one dollar per gallon. This crop, therefore, is a profitable enterprise to the extent of supplying local needs where the costs run no higher than the average for the six crops. As with other intensive culture crops, the hazards are greater than those for the staple field crops and the problem of marketing may become acute after all local needs have been supplied.

Two farmers on the cost route kept detailed records on peanuts with a total of 3.5 acres. The average cost per acre was $21.32, exclusive of land use charge, and the average yield per acre as estimated by the growers was 37 bushels or 888 pounds, which would make the cost per pound 2.4 cents. This allows no charge for land use or credit for forage. The U. S. Department of Agriculture estimate for average yield per acre and December 1 farm price for the state is 725 pounds and six cents respectively. Corresponding figures for Alabama, with an acreage 17.5 times that of Mississippi are 680 pounds and 3.4 cents. It would seem, therefore that peanuts have considerable possibilities in the section studied, especially on the sandier lands. In the peanut sections of Alabama, it is the usual practice to plant peanuts with corn. The corn is harvested after which the fields are grazed with hogs.

Table 17—Gardens—Cost by Items and Sales of Garden and Truck Crops

19 Farms—Jones Co., Miss.—1927

Farm No.	Acres per Farm	Man Labor	Horse Work	Seeds and Plants	Land use Charge	Fertilizer	Total Cost	Amt. of Sales	Net Cost	Net Profit
	No.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1	1.0	17.62	6.97	7.25	8.00	7.73	47.57	89.20	——	41.63
2	.3	3.45	1.63	11.25	4.00	1.95	22.28	——	22.28	——
3	2.8	17.70	7.05	46.41	20.00	20.00	111.16	319.32	——	208.16
4	3.1	24.75	18.33	11.50	15.00	18.72	88.30	11.00	77.30	——
5	1.4	6.96	5.12	45.00	12.85	30.05	99.98	59.00	40.98	——
6	2.1	13.72	8.38	13.75	6.00	7.60	49.45	——	49.45	——
7	.6	4.95	2.63	19.00	6.00	3.34	35.92	——	35.92	——
8	1.3	44.25	26.14	9.47	6.00	10.00	95.86	83.61	12.25	——
9	2.5	26.10	4.39	11.40	12.00	20.50	74.39	.30	74.09	——
10	3.1	27.22	46.26	7.70	15.00	16.50	112.68	30.00	82.68	——
11	1.7	27.45	12.70	10.00	7.00	5.55	62.70	——	62.70	——
12	.3	10.65	12.61	10.00	5.00	6.52	44.78	18.79	25.99	——
13	1.5	48.98	15.34	25.65	10.00	10.00	109.97	34.79	75.18	——
14	1.2	57.05	16.56	6.15	6.00	11.08	96.84	.25	96.59	——
15	1.0	39.45	37.34	19.00	12.00	6.00	113.79	5.00	108.79	——
16	2.1	39.97	29.05	20.00	8.00	9.00	106.02	27.17	78.85	——
17	.4	6.07	6.09	4.55	6.00	14.54	37.25	15.00	22.25	——
18	.2	11.70	5.04	5.00	3.00	10.70	35.44	18.55	16.89	——
19	.8	29.55	17.28	23.00	5.00	38.00	112.83	15.00	97.83	——
				Average per Farm						
	1.4	24.08	14.68	16.11	8.78	13.04	76.69	38.26	51.58	13.05
				Weighted Average per Acre						
		17.32	10.56	11.58	6.31	9.38	55.15	27.52	37.09	9.45

In addition to kitchen gardens, table 17 contains data on truck crops where the records were not kept in sufficient detail to permit a separate account. The net costs were charged to the household and credited to the farm, the assumption being that the products were worth just what it cost to produce them. This is contrary to all accounting rules, but since it would be equally unfair to use either what such produce would cost or what it would sell for in the nearest market, it was thought that, in general, this method was as good as any other.

In addition to reducing the cost of family living and possibly contributing to general healthfulness, the garden has possibilities for adding to the farm income where the surplus can be conveniently marketed. Farms 1 and 3 realized $41.63 and $208.16 above costs in addition to all garden produce used by the families.

Table 18—Workstock—Annual Cost of Maintenance per Animal Unit and Cost per Hour of Horse Work
Arrayed on Cost per Hour of Horse Work
19 Farms—Jones Co., Miss.—1927

Farm No.	Animal units per Farm	Value of Feed	Value of Pasture 1|	Depreciation	Other Costs 2|	Total Costs 3|	Appreciation	Net Costs	Work per A. unit	Cost per Work Hour
	No.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Hours	Cents
14	2.00	89.13	2.10	——	24.34	115.57	——	115.57	1285	9.0
13	4.55	75.27	1.39	1.10	13.32	91.08	——	91.08	954	9.5
8	2.00	91.60	2.10	——	19.58	113.28	——	113.28	1052	10.8
16	1.00	79.50	1.80	10.00	29.35	120.65	——	120.65	1103	10.9
18	2.00	67.75	2.10	17.50	20.78	108.13	——	108.13	860	12.6
17	2.00	70.70	2.10	25.00	15.72	113.52	——	113.52	867	13.1
3	4.00	68.0	2.10	8.75	13.87	92.72	——	92.72	697	13.3
1	2.00	46.10	2.40	25.00	20.41	93.91	——	93.91	698	13.4
19	4.00	65.13	1.80	6.25	20.65	93.83	——	93.83	696	13.5
4	4.00	59.06	1.80	2.25	12.31	75.42	——	75.42	536	14.1
6	2.94	71.76	2.10	3.40	25.42	102.68	——	102.68	678	15.1
11	1.00	99.50	2.10	10.00	22.85	134.45	——	134.45	878	15.3
7	2.75	66.35	2.10	7.27	16.60	92.34	——	92.34	490	18.8
9	5.00	56.82	2.02	27.00	13.22	99.06	——	99.06	517	19.1
12	2.00	99.00	1.80	25.00	26.87	152.67	——	152.67	796	19.1
5	2.00	77.50	——	——	22.27	99.77	20.00	79.77	390	20.5
2	2.00	56.88	2.40	——	15.56	74.84	——	74.84	320	23.3
15	3.00	77.80	2.10	1.67	20.14	101.71	——	101.71	401	25.4
10	6.00	56.25	3.00	——	10.12	69.37	——	69.37	250	27.7
					Weighted Average					
	2.85	68.88	2.02	8.28	17.31	96.49	.74	95.75	649	14.8

1| Fields after harvest.
2| Charge for man labor, interest and taxes.
3| Assumed that manure credit offsets building charge.

Next to the cost of man labor, the cost of horse work is usually the largest item of expense in crop production. Tables 18 and 19 show the cash and quantity cost respectively of keeping work stock with table 18 showing also the hours worked per head and the cost per work hour. Home grown feeds and man labor were charged at the same rate per unit on the different farms.

Table 19—Workstock—Annual Quantity Costs per Animal Unit Arrayed on Costs per Hour of Horse Work
19 Farms—Jones Co., Miss.—1927

Farm No.	Animal units per Farm	Grain Feed				Roughage			Pasture	Man Labor
		Corn 1|	Oats	Other	Total	Mixed Hay	Oat Hay	Total		
	No.	Pounds	Pounds	Pounds	Pounds	Tons	Tons	Tons	Days	Hours
14	2.00	4158	——	——	4158	1.38	——	1.38	105	74.4
13	4.55	3924	——	——	3924	.51	.53	1.04	69	52.5
8	2.00	4248	——	——	4248	2.18	——	2.18	105	67.3
16	1.00	4176	——	——	4176	1.07	——	1.07	90	99.3
18	2.00	2430	——	——	2430	1.70	——	1.70	105	87.4
17	2.00	3780	——	——	3780	.54	.37	.91	105	66.3
3	4.00	3780	——	——	3780	.30	.50	.80	105	46.6
1	2.00	2160	——	——	2160	.99	——	.99	120	83.2
19	4.00	3744	——	——	3744	.37	.25	.62	90	63.7
4	4.00	3420	——	——	34.20	.50	——	.50	90	55.0
6	2.94	2902	370	——	3272	.97	——	.97	105	84.5
11	1.00	3852	600	480 2|	4932	1.80	——	1.80	105	103.9
7	2.75	2998	——	36 3|	3034	.98	.27	1.25	105	76.2
9	5.00	3499	128	——	3627	28	——	.28	101	37.7
12	2.00	5040	——	——	5040	1.45	——	1.45	90	102.2
5	2.00	2700	——	——	2700	.50	1.50	2.00	——	81.3
2	2.00	2754	——	——	2754	.95	——	.95	120	61.6
15	3.00	4824	——	——	4824	.55	——	.55	105	69.2
10	6.00	2610	——	——	2610	1.00	——	1.00	150	32.8
Weighted Average										
	2.85	3477	43	11	3531	.81	.18	.99	101	62.7

1\| In ear unhusked—72 pounds to 1 bushel

2\| Sweet potatoes.

3\| Sweet feed.

Feed costs per head were fairly uniform on the different farms. This may be partially attributed to the fact that horses require some feed whether they are at work or not.

Considerable variation occured in the depreciation figures for different farms. Some of the animals were advanced in age to the point where depreciation was pronounced. A number were sold at considerably below the value at which they were inventoried, while only one farm shows an appreciation on work stock. This was due largely to the fact that those animals had not reached their prime at the beginning of the study. As 'other costs' contain the charges for man labor, interest on investment and taxes, they vary with the amount of labor expended in caring for the workstock and the valuations placed upon the animals.

The outstanding factor affecting the cost per hour of horse work is the hours of work done per animal. It is significant that the four farms having the lowest cost per hour also worked each animal the greatest number of hours while the four farms having the highest costs per hour also worked each animal the least number of hours. For economy in the use of horse work, it is imperitive that the animals work a reason-

able amount of time. The more they are worked, the lower the cost per hour tends to be. The value of the work will depend on the enterprise receiving it and the equipment with which the animal is associated. It has been suggested in this report that larger teams and equipment might prove profitable, but it should be stressed that any possible profit is dependent on making good use of any time saved. One man and one mule can conveniently cultivate 20 acres of general crops in the section. The same man and two mules with proper equipment can as easily cultivate 40 acres, and there are sections of the Cotton Belt where one man and four mules with adapted equipment cultivates 80 acres. Larger teams and equipment have possibilities. Usually, the cotton acreage is limited by what can be hoed and picked, which would necessitate the using of time saved on the cotton crop on some other crop or enterprise which required a comparatively small amount of man labor. Hay crops are worthy of consideration. In any case, the farm business should be so planned as to profitably utilize as much of the available horse work as possible.

Table 20—Milk Cows—Annual Cost of Maintenance per Animal Unit and Cost Per Pound of Butter Fat
Arrayed on Cost Per Pound of Butter Fat
19 Farms—Jones Co., Miss.—1927

Farm No.	Animal units per Fm.	Feed & Pasture 1|	Depreciation	Man Labor	Other Costs 2|	Gross Costs 3|	Appreciation	Net Costs	Fat per A. Unit	Cost per lb. Fat
	No.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Pounds	Cents
8	3.06	16.87	——	10.90	7.62	35.39	19.61	15.78	156.7	10.1
9	3.71	8.66	——	8.09	1.37	18.12	5.37	12.73	146.6	11.3
2	2.00	14.77	——	11.03	1.65	27.45	5.00	22.45	134.2	16.7
18	1.12	31.59	——	20.44	3.21	55.24	22.32	32.92	150.0	21.9
16	1.00	27.70	——	19.54	3.60	50.84	——	50.84	225.0	22.6
4	3.00	14.09	——	9.17	1.25	24.51	1.66	22.85	100.0	22.8
6	1.25	39.70	——	15.67	3.36	58.73	20.00	38.73	157.4	24.6
14	2.73	23.07	——	12.23	3.96	39.26	7.33	31.93	126.8	25.2
17	2.98	12.45	3.36	11.44	2.25	29.50	——	29.50	108.8	27.1
10	3.00	11.17	——	12.76	2.00	25.93	——	25.93	95.0	27.3
11	2.78	23.43	——	10.25	5.12	38.80	8.99	29.81	100.0	29.8
7	3.00	17.28	——	12.63	1.95	31.86	5.00	26.86	90.0	29.8
1	.88	27.86	——	16.25	4.97	49.08	5.68	43.40	100.7	43.1
15	3.72	21.45	10.75	11.72	2.34	46.26	——	46.26	100.0	46.3
13	4.66	5.13	3.22	10.66	2.39	21.40	——	21.40	74.6	46.8
12	.99	13.77	——	19.78	4.19	37.74	——	37.74	80.0	47.2
3	2.68	22.42	13.05	11.47	2.21	49.15	——	49.15	100.0	49.2
19	1.26	63.54	——	13.12	4.52	81.31	12.70	68.61	119.4	57.4
5	1.60	23.75	5.00	16.95	2.59	48.29	——	48.29	83.1	58.5
					Weighted Average					
	2.19	18.44	2.38	12.08	2.97	35.90	4.98	30.92	107.1	28.9

1\| Pasture item for fields after harvest.

2\| Horse work at cost and interest at 6 per cent.

3\| Assumed that manure and skim milk credits offset building and equipment charge.

Table 21—Milk Cows—Annual Quantity Costs per Animal Unit Arrayed on Cost per Pound of Butter Fat
19 Farms—Jones Co. Miss.—1927

Farm No.	Concentrates					Roughage			Pasture	Man Labor	Horse Work
	Cotton Seed Meal	Cotton Seed	Corn 1|	Other	Total	Hay	Cotton Seed Hulls	Total			
	Pounds	Pounds	Pounds	Pounds	Pounds	Tons	Tons	Tons	Days	Hours	Hours
8	523	——	23	——	546	.08	.08	.16	150	72.7	17.0
9	283	——	116	——	399	.03	——	.03	104	53.9	——
2	600	——	——	——	600	.15	——	.15	120	73.5	——
18	1161	——	——	——	1161	.04	.67	.71	105	136.2	——
16	500	——	432	——	932	.60	——	.60	90	130.3	——
4	400	——	240	——	640	.08	——	.08	105	61.8	——
6	800	——	230	——	1030	.92	——	.92	105	104.5	——
14	——	——	686	——	686	.64	——	.64	105	81.5	14.7
17	419	——	——	——	419	.06	.28	.34	105	76.3	6.4
10	100	——	——	——	100	.33	——	.33	150	85.1	——
11	475	263	——	732 2|	1470	.07	——	.07	106	68.3	——
7	437	22	240	3 3|	702	.12	——	.12	105	84.2	——
1	682	——	——	227 4|	909	.57	——	.57	120	108.3	2.3
15	——	53	1084	——	1137	.13	——	.13	105	78.2	——
13	54	——	62	——	116	.05	.05	.10	105	71.1	.4
12	606	——	——	——	606	.10	——	.10	90	131.8	6.1
3	1269	——	——	——	1269	——	——	——	105	76.5	1.1
19	1429	1189	——	——	2618	.99	——	.99	90	88.4	——
5	750	——	——	——	750	.62	——	.62	——	113.0	——
Weighted Average											
	438	68	195	49	750	.21	.05	26	108	80.5	2.9

1| In ear unhusked—72 pounds to 1 bushel.
2| Sweet potatoes.
3| Shorts.
4| Commercially mixed.

Tables 20 and 21 dealing with the dairy enterprises of the farms studied show some of the possibilities along this line. Feed and labor records were accurately kept, while it was necessary to partially estimate the production on a number of farms. From eight to nine months pasture on open range was not charged to these cows.

Farm dairying in the section was in a disorganized state due to the fencing law. Considerable numbers of cattle were sold and not a few farmers were discouraged.

With the exception of a few of the cooperators, cows were kept for home use only, and handling of the herd was more or less irregular. Little interest was taken in breeding and feeding. Those who took an interest in the enterprise realized a substantial profit. They, in most cases, sold butter and fed the butter milk to chickens or hogs. One pound of butter fat is equivalent to about 1.25 pounds of butter and the buttermilk is worth about 50 cents per hundred pounds where corn is $1.00 per bushel. Most of these farms could have profitably

sold butter at 40 cents per pound. Pervailing butter fat prices for the year averaged about 35 cents per pound.

With the new conditions under which the dairy enterprise must operate, it is not only possible to improve the quality of cows and general management, but necessary. Fenced pastures add to the cost and unless the pastures are improved, the feed cost will also be increased. Dairying has possibilities in the section, but success will depend on a thorough study of the enterprise in itself and in its relation to the other farm enterprises and the markets.

Table 22—Poultry—Annual Cost per Head Cost per Dozen Eggs 1|, and Net Profit per Head 2|
Arrayed on Net Profit per Head
19 Farms—Jones Co., Miss.—1927

Farm No.	Poultry per Farm	Value of Feed	Value of Labor	Cost per 3| Head	Eggs per Head	Cost per Doz.	Meat per Head	Value of Meat	Profit per Head
	No.	Dol.	Dol.	Dol.	Doz.	Cents	Pounds	Dol.	Dol.
3	75	1.70	.20	1.93 4|	7.8	24.6	19.2	3.83	3.86
8	92	.67	.09	.89 5|	4.3	20.9	6.1	1.36	1.76
11	52	.47	.23	.70	3.3	20.9	7.0	1.41	1.46
17	50	.38	.18	.56	6.3	9.0	1.8	.37	1.46
14	50	.43	.16	.59	5.0	11.5	3.0	.60	1.28
2	33	.30	.30	.60	5.1	11.7	2.3	.45	1.10
19	35	.38	.30	.68	5.0	13.6	1.7	.34	1.01
9	137	.25	.07	.32	3.4	9.5	1.4	.36	.96
6	48	.57	.17	.74	5.7	13.2	.9	.19	.87
12	55	.43	.16	.71 6|	2.6	34.7	5.0	1.02	.82
16	36	.53	.26	.78	5.0	15.7	1.7	.35	.82
5	85	.16	.14	.30	2.5	12.0	2.2	.44	.76
13	33	.45	.34	.79	4.3	25.0	1.6	.36	.63
1	15	.13	.20	.33	1.0	33.0	3.3	.66	.58
7	33	.38	.31	.69	3.5	19.9	2.0	.50	.51
4	39	.33	.25	.58	2.5	23.4	1.4	.28	.33
10	35	.46	.40	.86	3.0	28.6	2.1	.43	.32
18	33	.42	.39	.81	4.1	19.6	——	——	.23
15	75	.31	.16	.46	2.9	15.9	——	——	.12
				Weighted Average					
	53	.49	.19	.70	4.1	17.0	3.8	.78	1.12

1| Annual Cost per head divided by eggs produced. By crediting the value of meat, many farms would produce eggs at a minus cost.

2| Market eggs valued at 25 cents per dozen.

3| Assumed that manure credit offsets building charge.

4| Includes 3 cents for eggs.

5| Includes 13 cents for eggs and hatching.

6| Includes 12 cents for eggs.

Table 23—Poultry—Annual Quantity Costs per Head Arrayed on Net Profit per Head
19 Farms—Jones Co., Miss.—1927

Farm No.	Poultry per Farm	Corn & Sorghum	Mill Feeds	Total Grain	Skim Milk	Man Labor
	No.	Pounds	Pounds	Pounds	Gal.	Hours
3	75	38.0	38.0	76.0	——	1.3
8	92	26.6	7.0	33.6	2.5	.6
11	52	16.0	8.6	24.6	——	1.5
17	50	27.3	——	27.3	——	1.2
14	50	31.0	——	31.0	——	1.1
2	33	21.8	——	21.8	——	2.0
19	35	28.0	——	28.0	——	2.0
9	137	12.0	3.5	15.5	——	.5
6	48	23.5	6.0	29.5	——	1.1
12	55	27.5	2.7	30.2	——	1.1
16	36	38.0	——	38.0	——	1.7
5	85	11.8	——	11.8	——	.9
13	33	26.2	3.0	29.2	——	2.2
1	15	9.6	——	9.6	——	1.3
7	33	24.0	2.7	26.7	——	2.1
4	39	24.0	——	24.0	——	1.7
10	35	33.0	——	33.0	——	2.7
18	33	30.5	——	30.5	——	2.6
15	75	22.0	——	22.0	——	1.0
Weighted Average						
	53	23.7	5.0	28.7	.2	1.3

Few farm enterprises will pay as well in proportion to the investment as does the farm poultry flock. Table 22 shows the value of items expended on poultry together with production of eggs and meat, the cost of eggs and profit per hen. Table 23 shows the quantities of feed and labor expended

The poultry flock yields both eggs and meat and although one or the other may be made the specialty, the other is produced as incidental. For this reason, the figure used for comparing the several farms is the profit per head arrived at by valuing all eggs at 25 cents per dozen and unsold meat at 20 cents per pound. On this basis, all farmers showed some profit, but in some cases the profit was so small that it could have easily been turned into a loss by misfortune.

As will be seen, some farms made the greater amount on selling chickens as with farms 3, 8 and 11, while others, as farms 17 and 14 realized a greater amount from eggs.

Regardless of the product desired, success with the enterprise depends on good quality fowls, good feeding practices, and good management. An ordinary sized farm flock is usually more profitable in proportion to size of investment than a commercial poultry plant. To successfully operate the latter requires special study and application. The farm flock will secure a part of their feed from waste grains and

kitchen scraps, but it is probable that too much dependence is placed on this source of the flock's feed on most farms. There is little waste grain on the ordinary cotton farm, and where chickens must range abroad for bugs and worms, much of the food is used to supply energy which might otherwise be converted into eggs or meat. It should be noted that the farms making the largest profits also used the largest amounts of feed generally, and averaged more eggs and meat per hen. With few exceptions, they also had better bred flocks and gave them closer attention.

Considerably more skim milk was fed to chickens than was reported, as this item was available in irregular quantities and at irregular times, often being mixed with kitchen scraps. Some surplus garden vegetables were also fed for which no charge was made.

Table 24—Pork—Quantity Costs per Hundredweight of Dressed Pork With Values Arrayed on Cost per cwt. of Dressed Pork 17 Farms—Jones County, Miss.,—1927.

Farm No.	Pork Prod. per Farm	Feed				Value of Past.	Man Labor		Other Costs	Cost per Hund.
		1| Corn	Other Feed	Total Feed Amt.	Total Feed Value	2|	Amt.	Value		
	Pounds	Pounds	Pounds	Pounds	Dol.	Dol.	Hours	Dol.	Dol.	Dol.
13	928	334	——	334	4.63	.27	11.2	1.69	——	6.59
11	456	276	——	276	3.84	.51	17.3	2.60	——	6.95
15	610	313	——	313	4.34	.35	22.2	3.33	——	8.02
14	1493	526	——	526	7.30	.12	8.0	1.20	——	8.62
9	1922	494	10 3|	504	7.09	.20	9.4	1.41	——	8.70
8	864	242	424 4|	666	7.25	.38	11.8	1.77	——	9.40
2	418	344	144 3|	488	7.65	.25	14.4	2.16	——	10.06
4	835	647	——	647	8.98	.35	10.6	1.59	——	10.92
7	150	720	——	720	10.00	.11	13.4	2.02	——	12.13
6	832	389	108 5|	497	6.49	5.06 6|	10.2	1.54	——	13.09
3	517	731	39 3|	770	11.05	.12	18.4	2.76	.29 7|	14.22
12	566	604	44 3|	648	10.22	.38	19.5	2.92	1.38 8|	14.90
18	388	751	77 3|	828	12.06	.15	20.5	3.07	——	15.28
17	293	1032	——	1032	14.33	.08	12.7	1.90	——	16.31
19	721	1268	28 3|	1296	18.13	.20	13.4	2.01	——	20.34
16	199	1447	——	1447	20.10	.49	43.3	6.49	——	27.08
1	78	7754	——	7754	107.69	——	250.2	37.53	9|	145.22
					Weighted Average					
	704	608	56	664	9.13	.61	14.9	2.23	.03	12.05

1\| In ear unhusked. 72 pounds to 1 bushel.
2\| Fields after crop was harvested.
3\| Shorts.
4\| Shorts 104 pounds. Skim milk 320 pounds.
5\| Sweet potatoes.
6\| Corn and peas hogged off.
7\| Veterinary expense.
8\| Horse work 67 cents. Veterinary 71 cents.
9\| Cholera outbreak took nearly the whole herd.

Hogs were kept in the community primarily for home use. Table 24 shows the costs in quantities and values for producing 100 pounds of dressed pork. These figures are accurate, but due to changed conditions brought about by a requirement to keep hogs under fence, allowance must be made when using them for future planning.

In addition to the feeds shown, hogs were on open range fully half the time and more skim milk was fed than was reported.

Feed is the principal item of expense in the production of pork, and it may be readily seen that costs per pound of pork increase as the feed increases. This should not be interpreted to mean that hogs should be stinted on feed, but rather that they should be so bred and the corn supplemented with other feeds in such a way that they will make the best use of all feed.

Under the new conditions where hogs must be kept under fence, good management is more essential than under the old range system, but the possibilities for profitable pork production are increased.

For the future, where hogs are kept under fence, the following suggestions are offered:

1. Improve the stock by using a pure bred boar.
2. Breed so that the pigs will come about eight months before killing or selling time.
3. Guard against disease by building pastures on high ground so that all drainage will be away from the pen. Keep feeding ground and sleeping quarters clean. Keep buzzards, dogs, crows, and other germ carriers out of pastures and pens. Vaccinate as a last resort.
4. Provide an abundance of fresh water at all times with shade near by.
5. Provide ample pasture. Clovers, peas, beans, peanuts, or vetch is best, but for some seasons oats, sorghum, rape, or rye may be used. Feed as much corn as they will eat, supplemented with skim milk or tankage. The above methods will make a 200-pound hog in seven or eight months.
6. When hogs reach the proper size and condition, kill them or sell them. The fatter a hog gets, the slower and more expensive are the gains.

Table 25—Value of Items Furnished the Home and Value of Family Labor
19 Farms—Jones County, Miss.,—1927.

Farm No.	L. St. and L. St. Prod.	Crops and Garden	Wood	Use of Residence	Use of Auto	Man Labor	Horse Work	Total	Value Family Labor	Excess Furn. Home
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1	180.48	14.00	30.35	50.00	27.00	16.95	.80	319.58	——	319.58
2	221.99	36.28	21.65	50.00	82.84	——	——	412.76	64.35	348.41
3	334.30	59.00	4.85	120.00	47.66	.75	1.06	567.62	176.35	391.27
4	283.09	85.30	11.68	100.00	——	——	——	480.07	51.30	428.77
5	114.61	43.98	——	45.00	18.89	——	——	222.48	179.10	43.38
6	221.30	53.95	4.97	120.00	44.26	3.15	2.72	450.35	17.55	432.80
7	208.56	53.92	9.01	50.00	28.26	——	——	349.75	335.10	14.65
8	147.35	35.25	9.09	55.00	253.45	15.75	5.62	521.51	47.02	474.49
9	390.51	114.84	21.50	60.00	19.60	——	4.78	611.23	426.10	185.13
10	152.71	146.68	4.22	125.00	267.61	——	——	696.22	302.55	393.67
11	178.07	78.70	10.37	60.00	——	——	——	327.14	123.00	204.14
12	157.45	58.99	3.64	180.00	64.96	——	——	465.04	20.25	444.79
13	190.29	81.18	9.30	100.00	——	3.15	3.61	387.53	194.10	193.43
14	323.54	182.54	26.74	50.00	——	14.85	7.38	605.05	469.91	135.14
15	222.56	123.79	19.45	100.00	1.75	1.35	——	468.90	290.55	178.35
16	135.36	91.85	8.86	50.00	——	11.47	2.94	300.48	176.55	123.93
17	248.34	81.00	24.25	48.00	11.71	5.75	1.57	420.62	67.20	353.42
18	220.84	33.99	32.95	60.00	9.43	30.90	5.80	393.91	134.40	259.51
19	268.68	112.83	7.05	200.00	174.33	——	——	762.89	223.20	539.69
					Average per Farm					
	221.05	78.32	13.68	85.42	55.36	5.48	1.91	461.22	173.61	287.61

Every farmer must maintain his household, and in return he may have some family labor in addition to his own for operating the farm. Table 25 shows the value of the several items supplied the home by the farm, and the family labor received in return, by the 19 farms keeping records. The excess furnished the home represents a part of the farmer's income, since it or its equivalent would perhaps have been spent for food had the items not been produced by the farm. The charge for use of residence is an estimate based on valuation while that for use of auto is estimated from the percent of time that the auto was used for strictly household and social purposes. Other items are at cost, figuring man labor and family labor at 15 cents per hour.

Table 26—Auto and Truck Accounts
Automobiles—9 Farms—Jones County, Miss.—1927

Farm No.	Man Labor	Gas and Oil	Build. Charge	License and Taxes	Depre-ciation	Repairs	Gross Cost	Credits 1|	Net Cost	Net Profit
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
2	——	35.95	7.00	6.72	116.00	——	165.67	82.84	82.83	——
3	——	48.00	8.00	13.12	3.94	4.90	77.96	47.66	30.30	——
5	——	34.00	10.00	16.55	15.00	——	75.55	18.89	56.66	——
8	——	143.43	8.00	16.36	36.25	77.57	281.61	295.69	——	14.08
10	——	128.71	10.00	16.36	60.50	81.77	297.34	272.11	25.23	——
12	4.00	60.00	5.00	13.77	4.50	42.65	129.92	64.96	64.96	——
17	3.00	25.77	6.00	12.85	1.50	9.45	58.57	11.71	46.86	——
18	——	36.00	10.00	16.55	30.25	1.50	94.30	9.43	84.87	——
19	——	70.92	12.00	20.59	163.50	81.65	348.66	174.33	174.33	——
				Average per Auto						
	.78	64.75	8.44	14.76	47.94	33.28	169.95	108.62	62.89	156
				Trucks—7 Farms						
1	——	109.13	——	18.26	112.00	55.15	294.54	51.50	243.04	——
2	——	32.92	3.00	14.53	31.44	6.44	108.14	465.05	——	356.91
3	——	36.00	6.00	11.79	70.21	1.00	125.00	107.95	17.05	——
6	.75	86.87	5.00	13.93	12.00	102.75	221.30	54.26	167.04	——
7	——	32.00	6.00	14.53	60.50	——	113.03	28.26	84.77	——
9	——	45.63	10.00	23.05	66.50	50.80	195.98	90.85	105.13	——
15	——	17.00	——	——	.52	——	17.52	3.75	13.77	——
				Average per Truck						
	.11	51.36	4.28	13.73	50.45	33.71	153.64	114.52	90.11	50.99

1\| Household use and income from hire.

Records were kept on nine autos and seven trucks, some farms having one or the other and two farms having both. A few farms also had tractors, but the number was not large enough to tabulate. Mileages were not kept, so that it is impossible to say to what extent autos and trucks were used, nor is this so important in the case of autos since they are used largely for social purposes and much of the income from their use is in the form of satisfaction on which a money value cannot be placed.

In the case of trucks, the hours of use were kept, but much of the time recorded was doubtless spent in idleness while the truck was parked on the street or for loading and unloading. The figures, therefore, are useful only for showing the approximate cost of owning and operating the vehicles. More use would increase the costs and possibly the credits. The ratio in which these two items vary determines the profitableness in money values.

The relationship of the auto to the social life of the family precludes any serious discussion here of its value to the farm, but serious thought may well be given to the advisability of adding a truck or tractor to the farm equipment.

There are certain fixed costs such as interest on investment, taxes and shelter, which occur regardless of the amount of use. Other costs such as depreciation, fuel, oil and repairs vary with the amount of use. The tendency, therefore, is for the unit use cost to decrease as the amount of use increases. When contemplating the purchase of such equipment, one should compare the sum of the probable costs with the amount of time that the equipment can be profitably used either on the farm or for hire.

Tractors and trucks are used largely for the same purpose as are horses, and one of the outstanding mistakes made by truck and tractor purchasers is in retaining the same number of horses after the purchase without increasing the amount of work done. Idle horses consume much of the possible profit of operating trucks and tractors. If horses must be kept for certain operations, it may be more profitable in the end to do the plowing and hauling with them also. Here, as with many other phases of the farm business, it is necessary to sacrifice at one point in order to gain at another. Horses are slower and may lack the power to plow as deeply as can be done with a tractor, but such losses may be less than that incurred by letting the horses remain idle while the truck or tractor is in use. The farmer should carefully study the problem and try to arrive at the combination which, when related to the whole business will give the largest net returns.

The various enterprises and phases of the farm business have been discussed in connection with the several tables. In conclusion, attention should be called to the fact that each enterprise and phase should be considered in its relation to the other enterprises and the farm business as a whole. One may profitably go even farther and consider its relation to the community. Great possibilities for profit and satisfaction lie in the cooperation of neighbors or larger units in the production of similar varieties or grades for crops, cooperative buying and selling, cooperative truck routes, and ownership of machines, male animals, etc. In united effort there is strength, and of all classes, farmers are perhaps in the best position to profit by giving up some of their individuality for the common good of the group. The more successful farmers are constantly searching for better methods, and when better methods are found either in his own mind or in the experience of others, he at once puts them into use. Prosperity comes to those who study while they work as well as to those who hustle while they wait.

Publications of the Mississippi Agricultural Experiment Stations and Extension Service which should be of interest to farmers of South Mississippi:

Reports—General Farm Information—

- Station Bulletin—246—South Mississippi Branch Station—1927
- Station Bulletin—238—South Mississippi Branch Station—1926
- Station Bulletin—232—South Mississippi Branch Station—1925
- Station Bulletin—225—South Mississippi Branch Station—1924

Crops—

- Station Bulletin—251—Cotton Experiments—South Mississippi—1927
- Station Circular—69—Cotton Experiments—South Mississippi—1926
- Station Circular—63—Cotton Experiments—South Mississippi—1925.
- Station Circular—76—Corn Experiments—South Mississippi—1927
- Station Bulletin—180—Pasture and Forage Crops—South Mississippi
- Station Bulletin—206—Sweet Potatoes for South Mississippi
- Station Circular—57—Sweet Potato Experiments—South Mississippi—1924
- Station Bulletin—247—Wilt and Blossom-end Rot of the Tomato
- Station Bulletin—208—Peanuts

Livestock—

- Station Bulletin—244—Mule Feeding Experiments
- Station Bulletin—235—Soybeans for Dairy Cows
- Station Bulletin—218—Grazing and Feeding Trials with Hogs
- Extension Bulletin—21—Twelve Lessons on Hog Production
- Extension Bulletin—26—Helps for Mississippi Poultry Raisers

Economics—

- Joint Bulletin—1—Agricultural Progress and opportunities of South Mississippi
- Extension Bulletin—15—Cooperative Marketing
- Station Circular—73—Sources of net Income—80 Farms
- Station Circular—67—Comparing 20 Profitable and 20 Unprofitable Farms
- Station Circular—39—Cost of Producing Truck Crops—Copiah County—1921

Engineering—

- Extension Bulletin—34—Terracing in Mississippi
- Station Circular—Unnumbered—Mississippi Poultry House

Bulletin No. 257 September, 1928

Systems of Farming for the Hill Sections of Mississippi

By

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and

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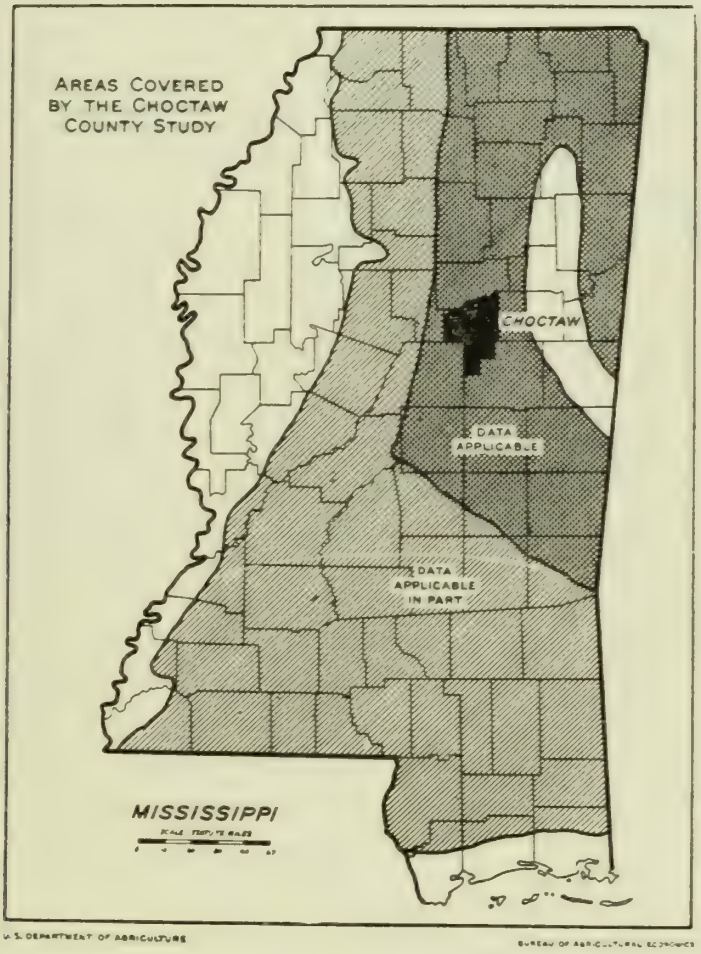

This bulletin should be applicable in particular areas where conditions are similar to those in the area where this study was made.

United States Department of Agriculture
Bureau of Agricultural Economics
in cooperation with
Mississippi Agricultural Experiment Station
A. & M. College, Mississippi

J. R. RICKS, Director

SYSTEMS OF FARMING FOR THE HILL SECTIONS OF MISSISSIPPI
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SYSTEMS OF FARMING FOR THE HILL SECTIONS OF MISSISSIPPI

The purpose of this bulletin is to point out some factors which affect farmers' earnings in the hill section of Mississippi, and to suggest some systems of farming which should be profitable in this and similar sections. The information contained should help in developing the more important crop and livestock enterprises and in combining these into a well balanced farming system.

To the farmer in the hill section of Mississippi the conservation of soil fertility and the economic use of fertilizers are important questions. The too common practise of continually cropping the fields with cotton or corn destroys the humus content and reduces the fertility of the soil. The quantity of fertilizer necessary to obtain good yields will depend somewhat on the cropping system followed. A choice of crops which will yield a profitable return to the farmer and yet serve to maintain the plant food in the soil is essential to a good long time farming program. To this end feed crops and livestock are needed and, wherever profitable, should be included in the farm organization.

The Nature of the Study and the Bases for Conclusions

The field work for this study consisted of obtaining farm business records by the survey method in Choctaw County, Mississippi, for the years 1920 to 1923 inclusive, and of obtaining detailed farm business records in the same section during 1924, 1925 and 1926. Data from the United States Agricultural Census, from the Division of Crop and Livestock Estimates of the Bureau of Agricultural Economics, from reports of the United States Weather Bureau, from reports of the Mississippi State Tax Commission, and from the Mississippi Agricultural Experiment Station were also used.

In the first part of the bulletin the physical characteristics of the section and the effect on crop and livestock adaptation are discussed briefly. A brief explanation is given of recent agricultural developments in response to changes in economic or natural conditions.

Secondly, the quantities of labor and materials used in producing crops and livestock on farms in the section are shown. These requirements are then considered in connection with the historical and experimental data and normal relations between the quantity of product and the cost factors used in production are obtained. From these normal relations and prices which seem likely for a period of years just ahead combinations of crops and livestock which should be profitable are suggested. Forms are provided and methods are explained by which systems of farming may be worked out on particular farms.

In this study, survey records were obtained from 15 farmers in 1920, 12 in 1921, 16 in 1922 and 21 in 1923 (1). These records showed the capital investment, the acreage and production of crops, the number and production of livestock, with the income and expenses for each farm. This material shows recent changes in organization, and progress on certain farms in the section. With a few exceptions, records were obtained from the same farms in consecutive years, and at the end of the period the farms were included in the detailed cost account work.

(1) These records were secured under the direction of J. N. Lipscomb. The data were not published separately.

Twenty-four farmers kept detailed cost records in 1924, 19 in 1925, and 19 in 1926. Records were kept on 17 farms for the three year period. These records show the investment in the business, the cash expenses and receipts, the man labor and horse work expended on crops and livestock, the material used on, and the production of crops and livestock, and the value of products which the farm contributed to the family living (1).

Crop seasons were unusually favorable for most crops during the three years of the detailed study. Normal yields have, therefore, been modified in light of yields for a longer period.

Fertilizer experiments in the community and livestock breeding and feeding trials at the Experiment Station indicate that the common practices in the county can be improved. The Experiment Station data consists of fertilizer tests conducted in the immediate community and elsewhere in the area; tests of cotton varieties; production of other crops and experiments with methods of breeding and feeding livestock. The results of these experiments are the basis for some of the fertilizer requirements and livestock rations suggested. References to published reports are given under the different headings.

DESCRIPTION OF THE AREA

The farm records were obtained in Choctaw County, Mississippi, located in what is known as the Short Leaf Pine Section, about 50 miles northeast of the geographical center of the state.

The topography of the county is marked by rolling uplands and level stream bottoms. The mean elevation is about 450 feet. Drainage is good, but the cultivated hill sides wash badly unless properly terraced.

The soils of Choctaw County have been grouped into 9 series and 16 types (2) with rusten very fine sandy loam and Pheba silt loam most important. Pheba silt loam predominated on the farms from which records were obtained, with Rusten, Collins, Orangeburg and Susquehanna series represented in small areas. In general, the soils in the section are lacking in phosphorus, and many soils are lacking in potassium (3). The nitrogen content of the soil depends largely on the cropping system followed in the past, but in most fields this element must be supplied through application of fertilizer. Practically all of these soils are deficient in lime. Heavy applications of commercial fertilizer are necessary to produce good crop yields in most of the area.

Rainfall is more than ample particularly during the winter and spring months. The average annual rainfall is 52 inches distributed as follows: winter 15 inches, spring 15 inches, summer 14 inches, and fall 8 inches. The high precipitation, together with the rolling topography, fine top soil and heavy subsoil results in severe washing of cultivated hillsides. The lighter rainfall during the fall months is favorable to successful harvesting of crops.

Because of the rolling nature of the land much water is lost in run off, while the lack of decayed vegetation impairs the moisture retaining pro-

(1) This material is reported in Mississippi Experiment Station Bulletins Nos. 228, 237 and 243. Progress reports for 1924, 1925 and 1926 respectively.

(2) Soil Survey of Choctaw County, Miss. Government Printing Office, 1923.

(3) The soils of Mississippi—Mississippi Station Technical Bulletin No. 7.

erty of the soil. Even with the high rainfall, crops sometimes suffer from ack of moisture during brief periods of drouth.

The winters of Choctaw County are short and mild while the summers re long, but not excessively hot. The mean temperature for the winter nonths is 46.6° F. Freezing may occur at night, but the temperature during he day is usually above freezing. Snow is rare.

During the summer months, June, July, and August the mean tempera- ure is 79.0° F., and is favorable to the growth of corn and cotton. The ummer nights are, however, comfortably cool. The growing season is ufficiently long that there is no danger of crop loss from early or late rosts. The average date of the last spring frost is March 28, and the verage date of the first fall frost is October 31. The average frost free pe- iod is 217 days (1).

The Adaptation of Crops

In the natural state, the soils of Choctaw County are low in fertility nd erode badly where terracing is not practiced, but with a liberal use f fertilizer and the construction of terraces, the growing of a variety f crops is possible.

Cotton succeeds best on the higher fields where the thinner lands are onducive to less vegetative growth and early maturity. Usually, such ields are farther removed from timber and bushy areas in which the oll weevil survives the winter.

Corn and other row crops for forage are more successful on the lower and oorer drained lands. Although the practice has been to fertilize corn only ghtly or not at all, it has been found that liberal use of fertilizer even n bottom lands yields good returns on the investment.

Oats are usually grown as a nurse crop for lespedeza seeding. Without he use of fertilizer and with the usual practice of sowing broadcast and lowing under, the yield is ordinarily very low. By the use of fertilizer and etter preparation of the seed bed, oat production could be profitably xpanded. Oats could also be used advantageously as a winter cover crop o prevent washing and for winter pasture.

Lespedeza is ordinarily successful as a hay crop on the bottom fields.)n the upland fields it fails as a hay crop unless the season is unusually ret. However, lespedeza supplies one of the principal plants in upland astures. When once well seeded, lespedeza reseeds itself for several suc- essive years.

Cow peas may be grown, with few exceptions, on any field of the ounty, production being limited by soil fertility and drainage. Soy beans ave succeeded in numerous instances, but the varieties best adapted to he county have not yet been determined. Vetches and clovers have never ecome established in the county due, perhaps, to a deficiency of lime in he soil.

Truck crops, including sweet potatoes, sugar cane, water melons, can- aloupes, tomatoes, and garden crops produce well in low sandy areas.

Natural pastures are very poor. Many of them consist of more or less

(1) Weather data from the records of the U. S. Weather Bureau Station at ouisville, Winston County, Mississippi, are taken to represent conditions in Choctaw ounty.

open woods, swamps, and old abandoned fields. Broom sedge is the predominating natural grass. Great pasture improvement is possible by stopping erosion where necessary and encouraging the growth of such plants as bermuda grass, carpet grass and lespedeza.

The county was originally covered with pine and hardwood forests, which have been largely cut away. The only remaining timber is old field pine and some of the less valuable deciduous timber. The soil and climate are very favorable to the growth of pine timber, and where the land can not be put to a more profitable use, such timber should be protected and encouraged.

Adaptation of Livestock

The lack of good pastures is perhaps responsible for the small numbers of livestock in the county. Few beef cattle are kept and dairy cattle are kept primarily to supply the family needs for dairy products. The county is free of ticks and with the establishment of more market outlets for dairy products and the possibilities for pasture improvement, dairying should become more important as a farm enterprise.

Pork production is limited by the scarcity of grain. Practically all corn produced is needed to feed work stock, so that, with a few exceptions, only enough hogs are kept to supply family needs. Some hogs have been shipped from the county when prices were especially favorable. Some expansion could be made in the production of hogs by an increased use of pastures and grazing crops.

Few sheep are kept in the county at the present time. When sheep were kept, the income was derived from wool sales and an occasional mutton sale. This income was insufficient to cover expense of fencing and losses by disease and dogs; so the enterprise was abandoned. Some profit might be made with small flocks of sheep where spring lambs were produced for market.

Chickens, up until the last few years, were kept mainly for family use. In recent years, sales of poultry and eggs have been increasing and much improvement has been made in farm flocks. The county is well adapted to poultry production, and this enterprise, as a part of the farm plan, pays well where ordinarily good poultry management is practiced.

AGRICULTURAL DEVELOPMENT IN CHOCTAW COUNTY

The first settlers in Choctaw county came principally from the Carolinas and Georgia, and the present white population is of almost pure native stock descended from these early settlers. The county was organized in 1833 and attained its present form in 1874. During the reconstruction period following the civil war, much of the agricultural land was abandoned, but at the time of the census in 1880, the county was developing rapidly. Population increased steadily until the invasion of the boll weevil in 1909. Since 1910, the population particularly the farm population, has been decreasing. The total population in the county increased from 9,000 in 1880 to 14,400 in 1910, but in 1920 the population was only 12,500. The reduction was caused by the movement from the farms.

Table 1 shows the farm population, number of farms, and land in farms

as reported by the United States Census since 1880. The number of farms and land in farms increased with population until about 1910. During the period from 1910 to 1925 there has been a decided decrease in population and land used for farming. This movement has been general throughout the Southern States and is only slightly greater for this area than for the state as a whole. The decrease in farm land was less rapid than the reduction in population and the tendency is for the average size of farms to increase slightly. The total amount of improved and cultivated land in the county decreased as did the average acres of improved and crop land per farm. For the most part the abandoned crop land was allowed to grow up to brush and trees.

TABLE 1—FARM POPULATION AND LAND IN FARMS 1880-1925 (a) CHOCTAW COUNTY, MISSISSIPPI

Year.	Population	Number of Farms	Land in Farms (Acres)	
			Total	Improved
1925	9,424	1,957	203,510	66,626(b)
1920	10,942	2,188	228,010	75,416
1910	13,589	2,583	237,768	98,422
1900	12,554	2,189	217,591	70,290
1890	10,580	1,544	199,527	59,996
1880		1,358	169,918	41,288

(a) Data from United States Census.

(b) Includes crop land and plowable pasture, but not land in buildings.

TABLE 2—ACRES OF CROPS 1879-1924 CHOCTAW CO., MISS. (a)

Year	Cotton	Corn	Oats	Cane and Sorgum	Hay and Forage	Sweet Poatoes
1924	10,586	23,050	1,032	313	2,904	275
1919	11,682	28,724	1,883	1,054	6,114	522
1909	22,932	26,045	2,500	484	3,193	560
1899	19,798	27,132	2,927	616	661	305
1889	18,576	20,412	4,200	464	712	472
1879	13,497	18,139	3,931			430

(a) Data from United States Census.

As shown in table 2 the acreage of cotton in 1924 and 1919 was only about 50% of the acreage in 1909. A smaller acreage of corn was grown in 1924 than in previous years, but in general the acreage of corn has decreased less than other crops. There has been no appreciable increase in crops planted to replace the cotton acreage abandoned. Figure 1 shows the acres and production of the important crops according to reports of the census since 1879. Although the census reports an increase in acreage of hay and forage crops in 1919 yet the acreage in 1924 was no higher than in 1909. Even in recent years the acreage planted to cotton varies considerably, the tendency being to increase the acreage following a profitable crop year. Figure 2 shows the changes in estimated cotton acreages for the years 1919 to 1926. Since 1919 the cotton acreage has normally been about 12,000 acres, but

dropped to one-half that in 1921 after the price decline of 1920 and increase somewhat in 1926.

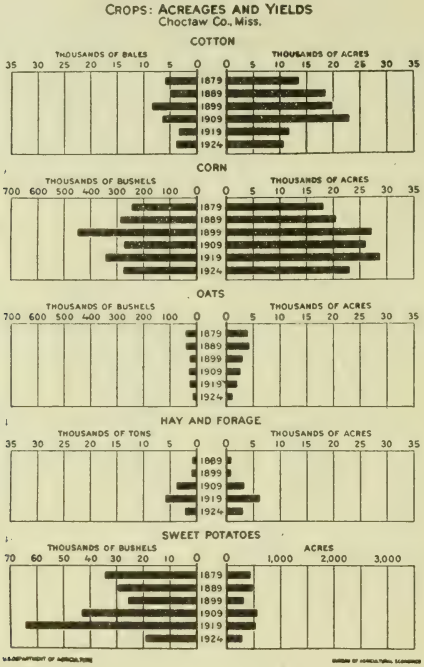


Figure 1—Census figures show that cotton and oats acreage have tended downwa since 1909. The acreages of corn and forage crops were greater in 1919, but less 1924 than in 1909.

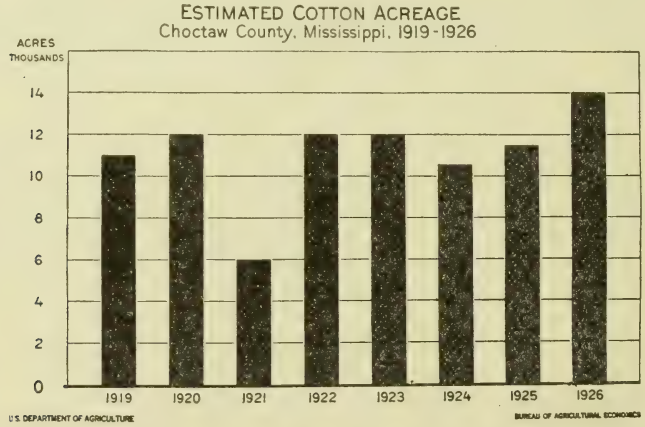


Figure 2—During recent years the acreage of cotton in Choctaw County has approximately 12,000 acres. With an abundance of land available, this acreage c be materially increased, should prices justify expansion without decreasing acr of other crops.

Table 3 shows the estimated average yield per acre of the important crops in Choctaw and in the 7 nearby counties having similar soil conditions. Cotton yields were above normal during the period from 1924 to 1926; however, yields of other crops were more nearly the average. The yields of most crops could be increased considerably by the use of more fertilizer and better cultural practices.

TABLE 3—ACRE YIELD OF CROPS, CHOCTAW CO., MISS., 1920-1926 (a)

Year.	Cotton Pounds	Corn Bushel	Oats Bushel	White Potatoes Bushel	Sweet Potatoes Bushel	Tame Hay Tons	Lespedeza Tons	Syrup Gallons	Soy Beans Bushel
1926	232	20	20	58	112	1.1	1.0	106	10
1925	197	16	20	66	105	.9	1.1	91	16
1924	174	12	18	90	46	.8	.....	62	8
1923	76	15	16	64	98	1.3	1.2	98	.....
1922	162	17	18	116	122	1.2	1.4	87	.....
1921	80	14	25	75	70	.9	.....	78	.....
1920	90	.....	.....	.....	.....	.....	.....	.....	.....
Average	144	16	18	78	92	1.0	1.2	87	11
(b) Av. of 8 counties	141	15	20	82	90	1.1	1.3	84	11

(a) Data from Division of Crop and Livestock Estimates.

(b) Average for Choctaw, Attala, Montgomery, Leake, Webster, Oktibbeha, Winston, and Neshoba Counties.

Since 1880 the changes in the number of livestock kept on the farms has coincided closely with changes in crop acres. The tendency to decrease the acres in cash crops has not been compensated for by any increase in the extent of the livestock enterprises. Table 4 gives the numbers of livestock on farms for the census years 1880 to 1925. The number of workstock on farms increased from 1880 until 1910, but has decreased somewhat since that time. The numbers of cattle and hogs are less at the present time than in 1890 and 1900.

TABLE 4—LIVESTOCK ON FARMS, CHOCTAW COUNTY 1880-1925 (a)

Year	Horses	Mules	Cattle	Swine	Chickens
1925	1,197	2,792	7,885	2,966	55,220
1920	1,917	2,579	9,819	8,025	61,476
1910	2,374	2,203	7,732	6,731	49,187
1900	2,228	1,945	10,673	15,049	42,424
1890	1,771	1,222	10,562	14,245	80,072
1880	1,058	1,135	7,802	11,969	37,569

(a) Data from United States Census.

It is probable that the decrease in farm population has allowed the less productive land to go out of cultivation. The period since 1920 indicates that the reduction in crop acres is not likely to continue, and that in periods of favorable prices, the acreage of crops can be increased readily. The increased acreage of cotton in 1926 following 2 years of favorable yields and prices illustrates this possibility.

TABLE 5—LIVESTOCK ON FARMS, CHOCTAW COUNTY, MISS. (a)

Year	Horses and Mules (b)	Cattle	Hogs
1925	3,825	6,616	2,776
1924	3,874	7,520	3,393
1923	3,885	6,794	3,520
1922	4,105	7,106	3,316
1921	4,368	6,432	4,179
1920	4,532	8,427	6,139
1919 (c)			
1918	3,818	6,876	5,640
1917	4,010	5,923	4,884
1916	4,362	5,863	1,524

(a) Annual Reports of Mississippi State Tax Commission.

(b) Includes Colts, Stalions, and Jacks.

(c) Not reported.

Numbers of livestock in Choctaw county as reported by the State Tax Commission shown in table 5 indicate a continuation of the trend shown by the reports of the census. In general, the numbers of work stock, cattle and hogs have been decreasing since 1920. The movement of population from the farms has not resulted in more extensive systems of farming, nor in the use of larger units of machinery to replace the labor lost to the farms.

Description of Farms Studied

The average size of the farms on which detailed records were obtained was 124.9 acres as compared to the county average of 104.1 acres reported by the census for 1925. These farms were not only larger than the county average, but also had a higher proportion of the land in crops. On the route farms the percent of land in crops was 37.4 as compared to 24.5 for all farms in the county.

About one-half of the cotton and some of the corn grown on the route farms was cultivated by share croppers. Nearly all of the share crops were on farms larger than the average and on a typical farm of 100 acres the crops are more often cultivated by the operator or by wage labor. Detailed cost records were obtained only for the fields operated by the owner and on these fields the yield was somewhat higher than that reported for the county. The acre yield of cotton on fields for which records were available from 1920 to 1926 averaged 166 pounds of lint as compared to an estimated average of 144 pounds for the county. Cotton yields were much higher for the three years from 1924 to 1926 than for the preceding years. Favorable weather conditions, smaller boll weevil damage, and perhaps a more effective use of fertilizers may be responsible for this yield.

The corn crop averaged 17 acres per farm, of which 6 acres were grown by share croppers. Corn yields were also higher on the route farms, averaging 19 bushels per acre as compared to a county average of 16 bushels. Lespedeza, oats, pea or sorghum hay, and miscellaneous truck crops each averaged about 1 acre per farm. The yields of oats and hay were practically the same for the route farms as for the county. Table 6 gives the average crop yields on farms for which records were obtained from 1920 to 1926.

A wide variation in crop yields is shown on separate farms for the same year. For instance in 1926 with an average of 232 pounds of lint

cotton per acre, yields on individual farms ranged from 130 to 550 pounds per acre (1). Much of this variation in yields is due to the kind and quantity of fertilizer used. The farm with the lowest yield applied only 160

TABLE 6—CROP YIELDS PER ACRE ON ROUTE FARMS, CHOCTAW COUNTY, MISS. 1920-1926

Year	Cotton Pounds	Corn Bu.	Oats Bu.	Hay Tons	Syrup Gallons	Sweet Potatoes Bushels
1926	232	20	16	1.38	121	.....
1925	214	17	12	.9	83	.....
1924	172	18	21	.9	.....	.....
1923	135	20	14	1.5	123	187
1922	163	19	16	2.0	95	181
1921	133	18	22	1.0	89	110
1920	113	16	14	1.4	114	144

pounds of fertilizer per acre while the farm with the highest yield applied 200 pounds of mixed fertilizer in addition to 5 tons of barn-yard manure. Figure 3 shows the apparent relation between the yield of cotton on the route farms in 1926 and the fertilizer applied per acre. An average application of about 250 pounds of fertilizer would have produced about 250 pounds of lint, but with few exceptions the higher yields were obtained through the use of larger quantities of fertilizer.

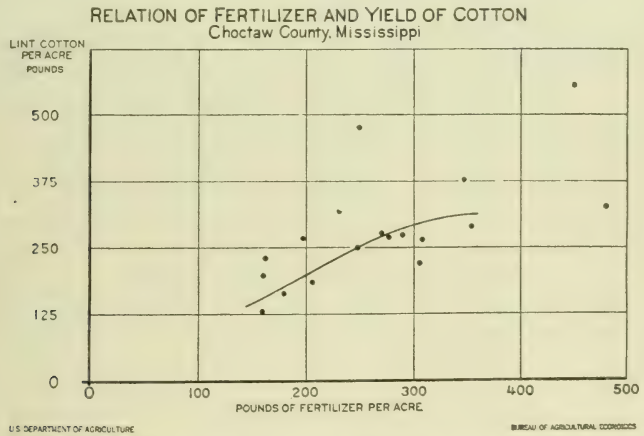


Figure 3—In 1926 the rate of fertilizer application per acre had a direct relation to the yield of lint. An application of 500 or 600 pounds per acre of an 8-6-4 mixture is most generally profitable as indicated by experimental tests covering three years in Choctaw County.

Since cotton is generally grown on higher lands where the natural fertility of the soil is low, the benefit from using fertilizer is evident. Corn, being better adapted to the lower, more fertile land, fertilizer is not so generally required.

The number of work stock on farms in 1926 ranged from 2 to 8 animals per farm. In 1924 and during a part of 1925 a number of farmers were producing dairy products for market, but for the remainder of the period,

(1) Mississippi Experiment Station Bulletin No. 243, Progress Report of Cost Production Route in Choctaw County, Mississippi, 1926.

with the exception of a single dairy farm, milk and butter was produced only for home consumption. In 1926 the number of cows ranged from 1 to 4 head on the general farms. An average of 44 chickens per farm and hogs to produce 666 pounds of dressed pork were kept.

Farm Returns in Choctaw County 1920 to 1926

Farm returns in the area from 1920 to 1926 are shown in table 7. The years during which detailed records were kept were years of fairly good yields and prices for cotton, and farm returns were higher than those shown by surveys in the same area for the four preceding years. The increase in farm expenses indicates that farmers were increasing their operations during the prosperous period. In 1926 the farm income on 19 farms averaged $743.00 and represented the return to the farmer for his own labor and his invested capital. After allowing $282.50, the average value of the operators' labor at 15 cents per hour, the farms returned a profit of 10.9% on the capital investment. The total value of products, including cash sales, increase in inventory, and the value of products used in the home, averaged $1,540. Cash and non-cash expenses, including depreciation and value of family labor other than that of the operator, were $743.00 per farm. Farm returns in 1925 and 1924 were somewhat higher than in 1926, due principally to higher prices received. The yields during these years were less than in 1926.

TABLE 7—FARM RETURNS, CHOCTAW COUNTY, MISS.

Year	Number of Farms	Investment Dollars	Value of Products Dollars	Total Charge Dollars	Farm Income Dollars
1926	19	4,229	1,540	797	743
1925	19	4,187	1,748	923	825
1924	24	4,020	1,375	477	898
1923	21	3,674	910	412	498
1922	16	3,687	757	398	359
1921	12	3,669	479	259	220
1920	15	3,729	224	479	—255

Production of Crops and Livestock

The results shown by the analysis of the detailed cost records have been considered in connection with results of crop and livestock experiments and from these a statement of the quantity of materials and the amount of labor which should normally be used in the production of each important farm product is given. The relations shown, while calling for a higher production for the quantity of cost factors used, than is usually obtained in this section, are such that many farmers following recommended practices will be able to equal them under normal conditions. In favorable years or under especially favorable conditions, production on many farms will exceed crop yields and livestock production shown.

Materials and Labor Used for Crop Production

Of the elements of production the farmer has a certain degree of control over those dealing with the variety of crop grown, methods of cultivation, and the quantity and kind of fertilizer used. The labor required to care for the crops is dependent on the nature of the soil, the topography, the preceding crop, and the size of machinery used as well as on the individuality of the operator, and to some extent on seasonal climatic conditions. Some fields require more labor than do others.

Yields and requirements of labor and material will differ from year to year. The average of a given year may not represent the normal expected over a period of years. The amount of material used may affect the yield and for this reason the normal requirements used may differ somewhat from the averages shown by the records of farms in the area.

Cotton

Table 8 shows the average amount of fertilizer, man labor, the horse work used and average yields obtained on 13 farms during the period of the study. Cotton yields were much higher in this area for 1924, 1925, and 1926 than they were during the period from 1920 to 1923, and were higher than is normally expected. During these favorable years, yields of one-half bale of lint cotton per acre were not unusual, and a few farmers averaged more than one-half bale for the three-year period.

TABLE 8—MATERIALS AND LABOR USED PER ACRE IN COTTON PRODUCTION, CHOCTAW COUNTY, MISS.

	Farms No.	Acres	Seed Bus.	Manure, Tons	Commercial Fertilizer			Man Labor Hrs.	Horse Work Hrs.	Ginning Costs, Dols.	Acre Yield Lbs.
					Phosphate Lbs.	Nitrate Lbs.	Mixed Lbs.				
Three year average on separate farms, 1924, 1925, 1926	1	3.0		5.5	169	71	67	246	78	4.13	412.7
	8	7.3		.7	152	4	72	95	46	2.70	269.7
	14	3.7		.5	95	55	60	112	43	2.67	267.3
	4	7.7		1.1	145	50	55	83	31	2.52	252.0
	16	11.6			209	79		132	43	2.42	242.3
	15	9.9		.4	200	98	56	123	43	2.35	235.3
	10	6.6		.1	106	47	23	73	34	2.30	230.7
	9	13.9		.3	172	32	81	87	37	2.25	225.3
	3	8.5		.3	178	25	80	67	31	2.17	216.7
	5	9.2		.3	149	48	15	65	30	1.90	190.0
	17	16.9		.8	96	18	69	99	40	1.90	189.7
	12	18.0		.2	167	42	70	135	45	1.89	189.0
	2	23.2			46	14	168	130	28	1.87	186.7
Three year average of all farms			1.15	.3	137	47	52	105	38	2.03	206
Suggested requirements and expected yield			1.25		261	196	44(a)	92	38	2.50	250

(a) Sulphate of potash.

Analysis of recommended fertilizer mixture is 8-6-4. The 501 pounds is equivalent to about 600 pounds of commercially mixed 8-6-4 fertilizer.

On these farms an average of 105 man hours of labor were used in producing an acre of cotton. Forty-two per cent of this labor was for picking and 26 per cent was for hoeing and chopping, all hand labor. Fifteen per cent of the labor was used in preparing the seed bed, applying fertilizer and planting. Cultivation made up another 15 per cent and hauling made up 2 per cent of all man labor used. Of these operations the labor of picking depends somewhat on the yield, while the amount of labor required for the preparation of the land varies with the type of soil, topography, and condition of the fields. The cultivation is, for the most part, performed with one horse implements and the man labor for cultivation could be reduced approximately one-half through the use of two-horse cultivators. While the saving in labor through cultivating cotton with two-horse cultivators would not reduce the total amount of man labor on this crop materially, it

would release some man labor to care for other crops at a time when corn and truck crops require attention.

With an average application of 236 pounds of commercial fertilizer per acre the three-year average yield on all farms was 206 pounds of lint cotton per acre. Some fields received light applications of manure. Average yields per farm ranged from 187 to 413 pounds per acre. The fertilizer used on these farms consisted principally of acid phosphate and nitrate of soda, although some mixed fertilizers containing potash were used. Figure 3 shows the importance of fertilizer in obtaining high yields of cotton on these farms in 1926.

TABLE 9—EFFECT OF FERTILIZER ON COTTON YIELDS
(Commercial Fertilizer)

Year—	Phosphate Pounds	Nitrate Pounds	Sulphate of Potash, Lbs.	Total Pounds	Approximate Analysis	Ginning Cost Dollars	Acre Yield (1)		Increased Yield, Lbs.
							Fertilized Plot, Lbs.	Check Plot, Lbs.	
(2) 1924	300	200	.....	500	9.6-6-0	2.20	221.2	78.5	142.7
(3) 1925	300	225	50	575	8-6-4	5.17	517.2	287.0	230.2
(4) 1926	300	225	50	575	8-6-4	4.71	471.0	197.7	273.3

(1) Estimated lint as one-third of seed cotton.

(2) Mississippi Station Bul. 226—Cotton Experiments, 1924.

(3) Mississippi Station Bul. 230—Cotton Experiments, 1925.

(4) Mississippi Station Bul. 241—Cotton Experiments, 1926.

Results from tests in the county conducted by the Experiment Station show that applications of fertilizer heavier than the average will prove profitable, and that the inclusion of potash is desirable in a fertilizer for cotton. Table 9 shows the yields of cotton from well fertilized plots for each year of the study and the increase in yield over that obtained from unfertilized plots. In each year the yield was increased substantially and a basis is established for suggesting a heavy application of well-balanced fertilizer.

In view of the increased production resulting from the judicious use of fertilizer and considering that the years 1924, 1925 and 1926 were particularly favorable to cotton, a yield of 250 pounds of lint cotton would seem likely to be obtained from the production requirements suggested in Table 8. This yield was exceeded on a number of farms in 1925 and 1926 even with lighter applications of fertilizer. In less favorable years the yield would be less and 250 pounds should represent the crop over a period of years when 500 pounds of balanced fertilizer are applied. Cost of ginning is estimated at $5.00 per 500 pound bale. On those farms which are more fertile than the average, a larger yield could be expected. The more fertile farms or those farms with manure available for distribution would probably require less commercial fertilizer.

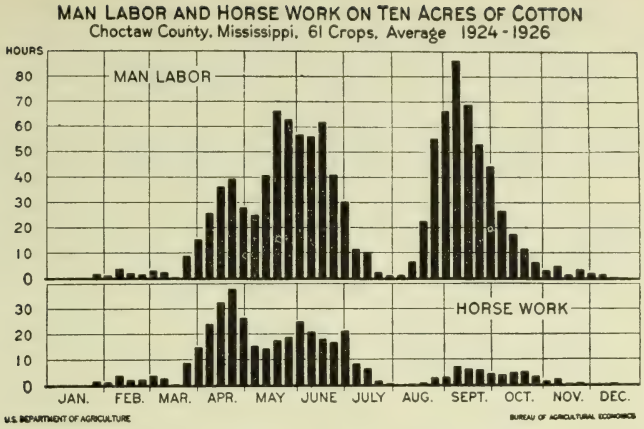


Figure 4.—Cotton calls for a great amount of hand labor in May and June and again in September. Farm enterprises which require a small amount of labor during these months are desirable.

Figure 4 shows the seasonal distribution of man labor and horse work on ten acres of cotton. This distribution is derived from the average amount of labor used each week on cotton on Choctaw County farms for the three years of the study. The peak of cotton labor comes during hoeing and chopping in May and June and again during the picking season in August and September. With the implements and practices common to the area, 10 acres of cotton is about as much as one man will ordinarily care for during the season when cotton demands most labor.

Corn

It is the common practice in this section to plant corn on the lower, more fertile land and to use little or no fertilizer. Yields on these farms for the three years of the study averaged 18.1 bushels per acre, the three year average on separate farms ranging from 12.0 to 37.5 bushels per acre. Corn does not compete with cotton as a money crop, but corn to meet the needs for feed is usually grown.

The amounts of man labor, horse work and materials used in the production of corn and the yields obtained on these farms are shown in Table 10. The averages for the three year period are shown for each item. Practically all farmers used some fertilizer, usually acid phosphate or nitrate of soda on some of their fields at some time, but few used sufficient fertilizer to obtain best results on all corn land. The average application per acre for the 3 years is 66 pounds. Although corn does not respond as readily to heavy applications as does cotton the results obtained indicate that more fertilizer could have been used profitably on many fields.

Fields are usually small and one-horse implements are used for cultivation after planting. Since the work of cultivating corn made up about 28 per cent of the total man labor on the crop the use of 2-horse machinery

TABLE 10—MATERIALS AND LABOR USED PER ACRE IN PRODUCING CORN, CHOCTAW COUNTY, MISS.

	Farm No.	Acres	Seed, Lbs.	Manure Tons	Com. Fertilizer			Man Labor Hrs.	Horse Work Hrs.	Acre Yield Bushels
					Phosphate Lbs.	Nitrate Lbs.	Mixed Lbs.			
Three-year average on separate farms, 1924, 1925 and 1926.	1	8.0		.....	149	.....	.....	62	58	37.5
	7	5.6		.2	206	49	.....	86	92	31.1
	15	9.2		.3	99	17	.....	50	38	23.0
	8	15.0		.....	16	.....	5	38	28	22.3
	17	11.1		.....	26	.....	6	59	40	21.9
	16	11.0		.....	85	7	.....	61	41	21.0
	13	11.7		.....	23	5	17	45	47	20.7
	6	18.8		.....	36	.....	6	52	45	19.6
	3	10.9		.....	14	47	.....	32	26	17.3
	5	9.6		.....	66	22	.....	30	27	17.0
	2	9.8		.....	44	.....	50	52	30	16.9
	12	18.6		.....	.....	1	.....	54	39	16.2
	11	8.7		.1	27	13	.....	30	25	15.8
	14	9.3		.1	62	5	.....	52	44	14.7
	10	10.0		.....	25	.....	6	29	24	14.6
	9	14.1		.....	46	2	.....	37	27	13.3
	4	11.0		.....	18	37	3	29	20	12.0
Three-year average on all farms.	.....	11.5	10.1	.1	51	9	6	44	35	18.1
Suggested requirements and expected yield.	.....	.....	10	.....	100	150	.....	38	35	25.0

would reduce the labor per acre on corn materially. The labor thus released from the corn crop could be used on other crops or to grow a larger acreage of corn.

Heavy applications of fertilizer have not always proved profitable, but applications of fertilizer in moderate quantities rarely fails to yield satisfactory returns. Results at the Holly Springs Station indicate an increase in yield of 8 to 10 bushels per acre for an application of 100 pounds of nitrate of soda with 150 to 200 pounds of acid phosphate (1). This same application with the addition of 50 pounds of kainit is suggested as a general fertilizer

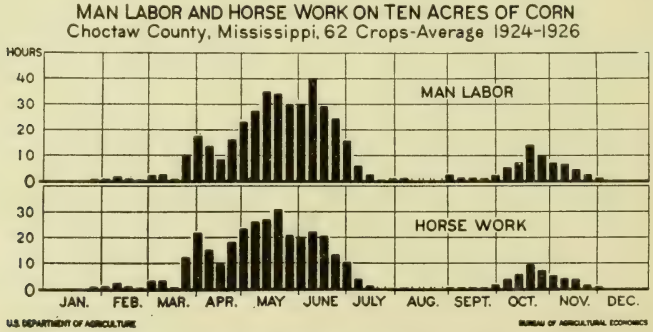


Fig. 5—Corn calls for the greatest amount of man labor in May and June. Labor on corn conflicts with labor on cotton during these months.

(1) Mississippi Station Bulletin 239. Report of the Holly Springs Branch Experiment Station, 1926.

for corn by the Raymond station (1), while the Poplarville station has secured satisfactory results by the use of nitrogen fertilizers alone (2).

Figure 5 shows the seasonal distribution of man labor on corn in Choctaw County. Any reduction in man labor during the months of May and June would help to reduce the peak of man labor at a time when both corn and cotton are requiring labor. The labor of gathering corn comes at a time when other work is not pressing.

Suggested requirements for corn production are given in Table 10. An application of 250 pounds of fertilizer per acre should give a yield of 25 bushels per acre. In view of the common practice of planting corn on the most fertile land it seems reasonable to expect the recommended application of fertilizer to produce the above yield. On the better land or on farms on which barn yard manure was available a larger yield would very likely be obtained.

Oats

Few farmers in the section grew oats, but it seems that more could do so with profit. In addition to providing excellent feed for livestock, oats is valuable as a cover crop and will provide some winter pasture in addition to the crop of grain. The common practice in the community is to cut the crop and feed it in the bundle. A larger acreage of oats on these farms would provide a substitute for other grain or would provide an additional crop for hay.

TABLE 11—LABOR AND MATERIALS USED PER ACRE IN PRODUCING OATS, CHOCTAW COUNTY, MISS., 1924

	Farms	Acres Per Farm	Seed Bu.	Fertilizer Nitrate Lbs.	Man Labor Hrs.	Horse Work Hrs.	Acre Yield Bu.
Individual Farms in 1924 (1)	17	6.0			14	10	26.7
	2	1.0			40	19	25.0
	4	1.5			18	25	25.0
	5	1.5			17	13	25.0
	24	1.8			14	29	17.1
	19	6.0			23	16	16.7
	13	2.5			21	11	16.0
	14	2.5			23	19	16.0
	9	4.0			20	32	12.5
Weighted average of all farms—1924, '25 and 1926—		3.7	1.7		15	14	16.4
Suggested requirements and expected yields—			2.0	200	15	14	30.0

(1) Taken from Progress report on Cost of Production Route in Choctaw County, Mississippi, in 1924. Mississippi Experiment Station Bulletin 228, page 9.

Table 11 shows the hours of man labor, hours of horse work and yields obtained on the farms reporting oats in 1924, together with the averages for all farms reporting oats during the period of the study. Suggested requirements for production are also given.

1. Mississippi Station Bulletin 231. Report of the Raymond Branch Experiment Station, 1925; and Mississippi Station Bulletin 240. Report of same Station 1926.
2. Mississippi Station Bulletin 225. Report of the South Mississippi Branch Experiment Station, 1922, 1923, 1924.

The general practice in seeding oats is to broadcast the seed and cover with a plow or harrow. With this method the seed is covered unevenly and a poor stand often results. More care in seeding would increase the probability of securing good stands.

An averge of 1.7 bushels of seed was used per acre. Few farmers applied fertilizer to oats yet tests of the experiment station show that fair yields can be obtained by application of sodium nitrate at the rate of 200 to 300 pounds per acre. It seems that with more care in seeding and with the application of some nitrate of soda that the yield given in Table 11, as a standard, could be easily obtained in most years.

The distribution of labor on oats is shown in figure 6. These oats were seeded in the spring, although fall seeded oats would have made as good or better yields and in addition would have provided cover for the field during winter, as well as some pasture. The labor distribution on fall seeded oats would not conflict with labor on other crops more than oats seeded in the spring. In each case the labor of seeding comes at a time when other work is not pressing. Oat harvest, however, does conflict with the cultivation of cotton.

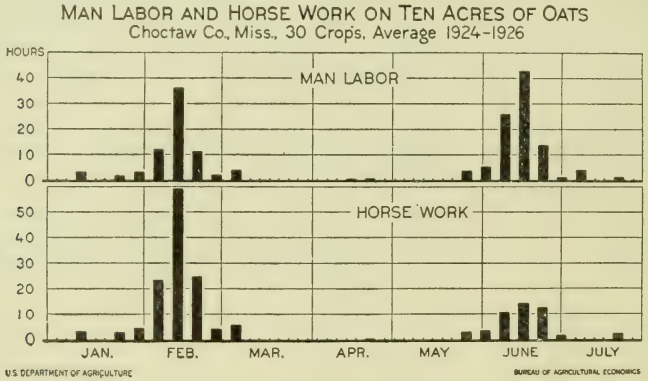


Fig. 6—Oats call for labor during February and June. The harvest labor comes at the same time as tillage labor on corn and cotton. Man labor for harvesting might be decreased by the use of modern machinery.

With no fertilizer the yield of grain for the three years was 16.4 bushels per acre. With the suggested application of fertilizer a yield of 30 bushels should normally be expected.

Lespedeza

Lespedeza is perhaps the best legume hay crop for the area, and occurs extensively in pasture mixtures. In Choctaw County it will make a growth suitable for hay on the low valley lands and on the most fertile uplands. On the thinner soils it grows and reseeds itself but does not reach a height suitable for mowing. Lespedeza seeded in fall oats in February at the rate of bushel per acre should yield a crop of hay following the oats and reseed itself to produce a crop of hay the second year. It is sometimes allowed to remain on the ground for a longer time, but is eventually replaced by persister grasses. Two crops of hay can, however, be expected from one seeding.

TABLE 12—MAN LABOR AND HORSE WORK USED PER ACRE IN PRODUCING LESPEDEZA HAY, CHOCTAW COUNTY, MISS., 1924

	Farm No.	Acres Per Farm	Man Labor Hours	Horse Work Hours	Yield Tons
Individual Farms—					
1924—	17	1.8	17	17	1.7
	5	4.5	3	6	1.2
	6	12.0	10	18	1.0
	14	2.5	29	44	1.0
	16	1.0	28	40	1.0
	1	8.0	19	24	.9
	15	3.0	12	12	.9
	3	3.5	11	21	.8
	4	3.5	9	1	.8
	8	2.0	19	28	.8
	10	2.5	15	21	.6
	11	2.5	16	24	.6
	13	11.0	2	4	.3
Three-year average of all farms reporting— 1924, 1925 and 1926		3.9	12	18	1.1
Suggested requirements and expected yield—			12	18	1.0

Table 12 shows the man labor and horse work used on lespedeza in 1924, as reported by a number of farms in Choctaw County. The yields of hay in 1924 and 1925 were somewhat lower than usual and it seems that a higher yield than that shown by the average of the three years might normally be expected. Since many of the fields were abandoned in 1925 and 1926 some of these must have been nearly run out and heavier yields could have been obtained on new seedings in 1924. The yield in the year ranged from .3 to 1.7 tons per acre with an average of .9 tons. The labor reported in 1924 includes labor of seeding on some fields and labor for hauling on all. Much of the variation in labor used is due to these factors.

The crop of 1925 was practically all from volunteer seedings and with no seeding labor reported the average labor used is low. The crops in 1926 were all volunteer seedings but with the high average yield the labor used is higher. Labor reported here includes hauling from the field. Fertilizer is not commonly used on this crop since the lower more fertile land only is recommended for growing lespedeza hay and if the preceding oat crop was fertilized no additional fertilizer is needed. On the suggested requirements no man labor or horse work is included for seeding lespedeza since it is assumed that the crop would be seeded with oats every other year.

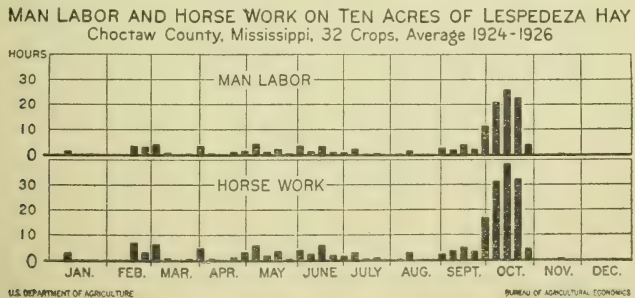


Fig. 7—Lespedeza is usually harvested late in the season and interferes very little with other crop labor.

The distribution of labor and horse work on 10 acres of lespedeza is shown in figure 7. The peak of labor on hay comes late in the fall when other work is not pressing, and labor on hay does not interfere with other crop work. On most farms there is some land suitable for growing lespedeza that is now lying out. Considering the value of the legume in the cropping system, and a need for more high grade roughage on most farms, it seems that the acreage of lespedeza could profitably be increased. On all the farms the hay was cut after the seed had ripened so that the field would be reseeded. The hay may be harvested at any time from August to October depending on seasonal conditions and the degree of seed maturity desired.

Sweet Potatoes

Some potatoes can usually be sold on the local and nearby markets at fair prices. When the low acre cost is considered in relation to the yield obtained, it should be a profitable practice to produce some potatoes other than those used on the farm. In years of low prices the surplus potatoes could be utilized as feed for livestock. The man labor and horse work on potatoes, as shown in figure 8, does not conflict seriously with other crop labor. Where plants are transplanted from vine cuttings 3 bushels of potatoes will furnish cuttings for an acre. Fertilizer is used sparingly but an application of 8-4-4 fertilizer is recommended where large yields are desired. Yields of from 100 to 200 bushels should be obtained. (1).

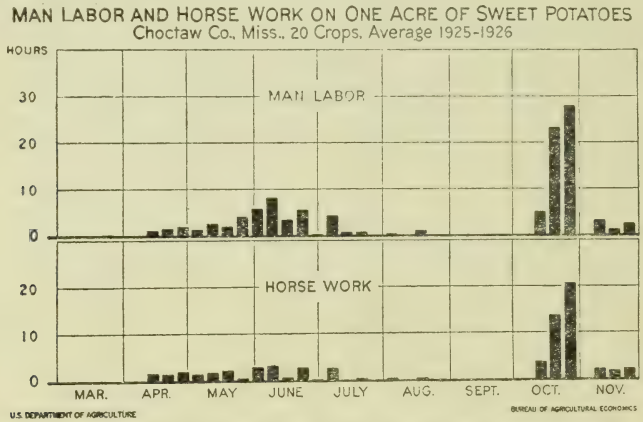


Fig. 8—Sweet Potatoes work in well with other crops, but call for some labor at the same time as corn and cotton.

Cane and Sorghum

Sugar cane and sorghum for molasses are grown on many farms primarily for home use. Where a local market for molasses is available sorghum or sugar cane will return a good profit per acre.

Sugar cane syrup is preferred by the market and usually sells for about 50 per cent higher price than sorghum molasses. The crop is usually planted on low fertile soil or is given a covering of barn yard manure. Where fertilizer is used an application of equal parts of acid phosphate and cottonseed meal is suggested. Sorghum will normally produce 80 to 100 gallons of molasses per

(1) Mississippi Joint Bul. 1. Agricultural Progress and Opportunities of South Miss.

acre. Sugar cane may yield considerably more than this in favorable seasons and the yield should normally be somewhat higher than that received from sorghum. In addition to the molasses the sorghum cane should yield about 20 bushels of seed per acre. About 117 hours of man labor and 92 hours of horse work are required to care for an acre of this crop and make it into molasses. (1).

Materials and Labor Used for Livestock Enterprises

Extensive data on the feed and labor used in the production of livestock and livestock products are not available from the farm records. On most farms the livestock enterprises are relatively unimportant and usually are supplementary to cotton growing. Work stock are maintained to care for the crops. The products from cows, hogs, and poultry are, for the most part, used in the home.

Work Stock

The horses and mules kept for work stock are generally small, ranging from 800 to 900 pounds in weight and are adapted to work in the cotton fields. Since much of the labor on cotton is hand labor and the crop acreages are small, the work stock is used less than in some other farming sections, and here the animals are allowed to run in pastures for long periods. With an extensive use of pasture and light farm work the feed allowance per head is less than in many other sections.

The quantity of feed used and the hours of work per animal as reported by the farm records is given in Table 13. For all farms the feed used per

TABLE 13—FEED AND LABOR USED PER HEAD BY WORK STOCK, CHOCTAW COUNTY, MISS.

	Farms	Average No. per Farm	FEED			Total Grain Lbs.	Roughage Tons	Pasture Days	Man Labor Hours	Time Worked Hours
			Corn Lbs.	Oats Lbs.	Mill Feed Lbs.					
Three-year average on separate farms,	1	3	3,101	136	11	3,248	.7	102	67	810
	12	3	2,880	128		3,008	.4	120	87	808
	8	3	2,630			2,630	.8	104	66	799
	14	2	2,082	306		2,388	.5	127	60	798
1924	5	3	1,962		247	2,209	1.1	121	64	772
1925	3	2	2,429	97	132	2,655	.3	94	66	728
1926	6	3	2,542			2,542	.7	87	34	715
	16	3	2,654	568	84	3,306	.9	81	79	672
	15	2	2,322	26	392	2,740	.7	145	52	660
	10	2	2,492	155	17	2,664	.6	113	64	649
	7	2	2,404	182		2,586	.7	182	62	609
	17	3	2,623	50		2,673	.8	128	66	567
	9	3	2,304	60	8	2,372	.5	51	63	497
	2	3	2,652	294	466	3,412	.2	112	62	484
	13	2	2,996		32	3,028	1.4	108	46	466
	4	2	2,135	22	68	2,225	.6	118	58	442
	11	2	2,155	184	5	2,344	.7	142	72	435
Weighted average all farms, 1924, 1925 1926		2.7	2,481	115	75	2,671	.7	118	59	637
Suggested requirements for 850 pound animals			1,820	780		2,600	1.4	110	60	600 to 1000

(1) Miss Experiment Station Bul. 237, Progress Report on Cost of Production. Route 1925.

head during the year averaged 44 bushels of corn, 3.6 bushels of oats, 75 pounds of mill feed, and .7 tons of roughage. The distribution of average quantity of feed per head on the separate farms indicates that there is quite a wide variation in the feed used by different farmers.

Fig. 9—Where pasture is plentiful and feed is produced on the farm, it may be more economical to raise rather than purchase mules for replacement.

The animals were worked an average of 637 hours each per year or an average of 80 days of 8 hours each. Some farmers used their work stock almost twice as much as others. The work stock were on pasture for 118 days and in addition were on pasture at night throughout the summer.

The average quantity of feed consumed would allow a daily ration of 10 pounds of grain and 5 pounds of hay for the period when not on pasture. The feed reported during 1924 is very light and is probably less than the quantity fed normally. When working, the horses were fed on corn and a small amount of lespedeza, and the ration normally given is low both in protein and dry matter.

The ration recommended by the experiment station calls for 50 bushels of corn, 40 of oats and 2¼ tons of hay for a 1000 pound horse on dry lot feeding for a year. For an 850 pound animal this would be 10 pounds of grain and 11 pounds of hay daily. Horses fed on this basis and on pasture without supplementary feed for 105 days during the year would require approximately 2600 pounds of grain and 2860 pounds of hay. The suggested requirements for an 850 pound horse as given in Table 13 would substitute some oats for a part of the corn in the ration most commonly used in the section and would increase the allowance of hay.

Milk Cows

Only one farmer on the route made dairying an important enterprise, but with a market for whole milk or butterfat available dairying presents one alternative to cotton for the farmers in this section. The quality of the cows now kept could well be improved and a producer who planned to start a herd for commercial production could profitably obtain better cows than are now

being milked. The average production per cow for the three years is only 128.5 pounds of butterfat annually. This is equivalent to 2570 pounds of 5% milk. The cows kept were small but produced milk with a high percent of butterfat. A farmer with a reasonably good herd of cows should be able to obtain a production of 4000 or more pounds of 5% milk. Good profits cannot be expected from cows that will not reach this production.

The feed consumed and the labor used per cow is given in Table 14. As nearly all the cows included in this report were kept to produce dairy products for home use only, no particular effort was made to obtain a higher production. Production could undoubtedly have been increased through heavier feeding. These cows received on the average, 876 pounds of concentrates of which 70 per cent was cottonseed or cottonseed meal. In addition, the cows received 1100 pounds of roughage and were on pasture for about 230 days.

TABLE 14—FEED AND LABOR USED PER COW FOR MILK PRODUCTION

	Farm Number	Cows Per Farm	FEED USED						Pasture Days	Man Labor Hours	Production of Butterfat, Lbs.
			Cottonseed Meal, Lbs	Cottonseed Lbs.	Corn Lbs.	Other Concentrates Lbs.	Total Concentrates, Lbs.	Roughage Tons			
Three-year average on separate farms 1924, 1925, 1926	9	2	581	.....	.....	280	861	.5	183	85	257
	1	5	308	487	310	32	1,137	.8	225	91	196
	6	13	974	.....	189	127	1,290	.5	178	73	166
	11	2	409	135	120	.....	664	.4	224	115	155
	16	5	362	195	600	119	1,296	.4	194	96	153
	3	2	323	308	.....	213	844	.8	187	83	132
	13	5	221	135	350	218	924	.8	203	63	122
	8	4	370	240	.....	38	648	.5	198	73	115
	15	3	327	309	358	109	1,103	.6	205	97	112
	10	2	211	310	.....	.....	521	.7	215	87	109
	4	3	481	221	.....	185	887	.8	194	85	107
	2	4	314	50	.....	133	497	.5	206	73	106
	17	2	160	679	91	50	980	.7	185	87	103
	14	3	319	221	88	197	825	.7	230	91	98
	5	4	203	265	424	.....	892	.5	239	80	97
	12	3	253	136	127	57	573	.3	199	100	93
	9	3	190	259	.....	27	476	.5	155	89	83
Weighted average all farms 1924, 1925, 1926			419	197	159	101	876	.6	229	79	129
Suggested requirements and expected production			300	.....	600	300(1)	1,200	1.5	215	80	200

(1) Made up of oats.

The seasonal distribution of labor on cows is shown in Figure 10.

Feed requirements in addition to pasture to produce 4000 pounds of milk per cow are given in Table 14. The allowance suggested would provide a ration of 7.8 pounds of grain and 13 pounds of hay daily for 150 days. This feed would need to be supplemented by some winter pasture to keep the cows in a full flow of milk. Under farm conditions the grain ration would probably

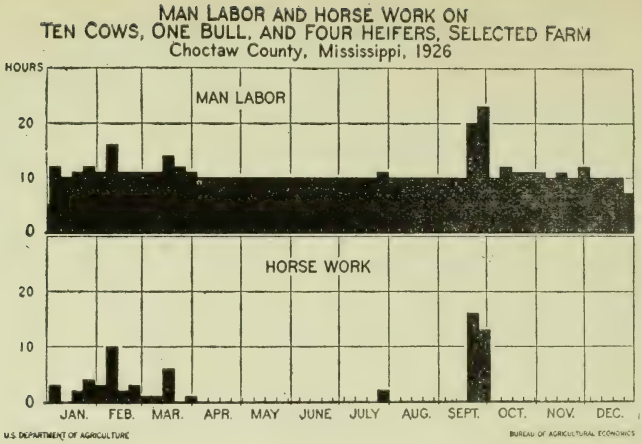


Fig. 10—Dairy cows provide an outlet for labor during the entire year. The farmer as a business man may profit by giving himself and family a steady job.

be distributed over a longer feeding period than 150 days, and cows would receive some grain while on good pasture. For the expected production it is assumed that the cows will have the ability to convert the feeds into milk.

Fig. 11—Dairy cows permit a more even distribution of the farm labor, aid in maintaining soil fertility, furnish a home market for farm grown feeds, and thus add to the farm income.

The long pasture season reduces the quantity of hay required and also displaces the succulent feed usually provided for in a dairy ration. Few farmers turning from cotton to dairy production would have a herd large enough to justify the use of a silo for the short feeding season. Cows with the capacity to produce more than 4000 pounds of milk will require heavier rations and a larger proportion of concentrate feed.

Good pastures are of prime importance to successful dairying in this sec-

tion. Natural pastures are ordinarily poor and where necessary should be improved by terracing and stopping washes. Good pasture mixtures including such plants as lespedeza, bermuda grass, and carpet grass should be introduced where these plants are not already established. (a).

Pork Production

Hogs are more often kept to produce pork for home consumption than for market. A few farmers produced pigs for sale. The average annual production per farm for the period of the study was 643 pounds of dressed pork, or the equivalent of 860 pounds of live pork. The hogs fed out are often purchased as small pigs, kept in a dry lot or close pen, and fed out on corn supplemented with skim milk, shorts, and kitchen waste. Under these conditions a surplus production of pork would usually be unprofitable. A few farmers, however, are making use of pasture in pork production and it seems that with the use of pasture crops pork production can profitably be increased on a number of farms. The use of pasture crops and the production of light rather than heavy hogs would materially reduce the grain required per unit of pork.

The feed and labor used in producing 100 pounds of live pork on farms in this study are shown in Table 15. The grain used in the production of 100 pounds live pork was 439 pounds in addition to the milk, pasture, or kitchen waste. Where breeding stock was kept the feed consumed by the breeding animals was included in the average feed per 100 pounds of pork. The total quantity of grain required could in many instances be reduced by the use of

TABLE 15—FEED AND LABOR USED IN PRODUCING 100 POUNDS OF LIVE PORK, CHOCTAW COUNTY, MISS.

	Farm Number	FEED USED			Man Labor Hours
		Corn (1) Pounds	Mill Feeds Pounds	Total Concentrates Pounds	
Three-Year average on separate farms	2	200	59	259	11
	3	336	.....	336	10
	5	364	33	397	13
	16	377	57	434	12
	4	338	100	438	14
	11	352	87	439	17
	12	460	.....	460	13
	7	331	157	488	14
	15	453	38	491	16
	8	514	17	531	10
	13	525	7	532	10
	1	553	9	562	15
	9	577	17	594	16
	14	548	63	611	17
	6	563	52	615	9
	17	579	39	618	19
	10	596	33	629	21
Weighted average all farms 1924, 1925, 1926		400	39	439	13
Suggested requirements for pork production		322	33 (2)	355	12

(1) Basis of shelled corn.
(2) Tankage in lieu of skim milk.

(a) For other suggestions on dairying see Mississippi Station Bulletin 166—"Dairying on Cut-Over Pine Land."

supplementary feeds such as tankage or fish meal, the use of pasture or the disposal of the hogs at about 200 to 225 pounds rather than feeding them to heavier weights.

Growing pigs on good pasture should receive a mixture of corn and tankage in a ratio varying from 9 parts of corn to one of supplement for young pigs to one of 18 parts corn to one of supplement for well grown pigs. For dry lot feeding the ratio of supplement to corn should be doubled. (a). Substitute feeds can be used for either corn or tankage . Where skim milk is available a ratio of 2 or 3 pounds of milk to one of corn will balance the ration effectively. Fish meal may be substituted for tankage pound for pound. Shorts makes a good feed for young pigs but it is usually more expensive than the other protein supplements. Pigs on good pasture should produce 100 pounds of gain on 350 pounds of balanced concentrate mixture. (b). Suggested requirements for producing pork are given in Table 15 and should meet the requirements on most farms in the section. The ration consists of corn and tankage and assumes that pasture will be available for the greater part of the year. The feed allowance provides an average ration of 3 pounds per day for maintenance of the sow and assumes the production of 1500 pounds of live pork from each sow. Where skim milk is available the tankage could be replaced and if sufficient milk was available the quantity of grain would be reduced somewhat.

Sheep Production

At the present time few sheep are kept in the hill sections, but a farm flock of ewes to produce lambs for the early market should be profitable on many farms. In this section sheep may be kept on pasture for the greater part of the year and will require very little concentrate feed. A ewe on good pasture would require no grain except during the breeding season and for the short feeding period during the winter. Ewes lambing in December to produce lambs for the June market should receive some feed in addition to roughage during the winter months. The amount of feed shown in table 16 would allow a ration per ewe of one-half pound of cotton seed meal and one and one-third pounds of hay for 90 days when the sheep were not on pasture, and would allow one-half pound of cotton seed meal per ewe per day for 30 days at breeding time in July.

Lambs running with ewes in good pasture will eat very little grain but to insure the lambs being ready for market a grain mixture of equal parts corn, bran, and oats is advisable. Market lambs would consume about sixty

TABLE 16—FEED USED FOR SHEEP PRODUCTION (1)

Feed Per Head	For 100-lb. Ewe	For Lamb to Weigh 75 Lbs.
Cotton Seed Meal (lbs.)	60	.....
Mixed Grain (lbs.)	.....	60
Hay (lbs.)	120	.....
Pasture (days)	275	150
Production Wool (lbs.)	4	.....
Live Weight (lbs.)	.....	75

(1) Based on unpublished data of the Mississippi Experiment Station.

(a) Mississippi Extension Bulletin 38—"Swine production in Mississippi."
(b) Henry & Morrison—"Feeds and Feeding."

pounds of grain each and should weigh about 75 pounds. As the lambs grow older they will consume more corn and less of oats and bran than the equal parts mixture for creep feeding.

A flock of sheep, under good management, should return a lamb for every ewe kept. Replacements in the ewe flock should be made about every 5 years.

A sufficient number of sheep pastures should be provided to permit the flock to be shifted at least as often as alternate years. Such shifting guards against infestation with stomach worms, the chief hazard of the sheep enterprise in the area. No trouble should be experienced from dogs if the sheep range within sight of the house and are penned at night.

Poultry Production

Like the other livestock enterprises poultry production is primarily to meet the needs for home use. The average size of the farm flocks for the 3 years was 48 birds. Egg production averaged 40 eggs per hen per year. A small flock of poultry will obtain a large part of its feed by ranging over the farm, but to obtain a reasonably high egg production some extra feed and attention must be given the hens. An ample, balanced ration, with proper housing, early hatching, and rigid culling would increase egg production on most farms.

Table 17 gives the amount of feed reported for poultry on these farms for the 3 years. The grain given consisted principally of corn. A very few farmers fed mill feed and a few fed some skim milk to the chickens. Even with the low production the poultry was a paying enterprise and one that might be increased with profit. A flock of 100 hens would require very little more la-

TABLE 17—FEED AND LABOR USED PER HEN IN POULTRY PRODUCTION, CHOCTAW COUNTY, MISS.

	Farm Number	Size of Flock Numbers	FEED PER HEN			Man Labor Hours	Eggs Produced Number
			Grain Pounds	Mill Feed Pounds	Milk Gallons		
Three-Year average on separate farms 1924, 1925, 1926	15	29	28	3		2.4	57
	14	41	20	3		1.5	53
	13	76	17	4		.8	52
	9	32	21	1		1.9	50
	5	55	11	.....		1.0	50
	11	42	11	6		1.6	49
	4	38	11	4		1.8	46
	7	59	9	7		1.2	44
	10	32	24	.....		2.0	44
	6	70	25	3		1.2	42
	12	52	25	.....		1.7	41
	1	71	17	.....		1.1	40
	16	55	17	1		1.3	40
	2	38	10	.....		1.5	36
	8	57	24	1		1.1	35
	17	41	28	.....		1.7	33
	3	39	19	.....		1.5	29
Three-Year average of all farms—1924, 1925, 1926	.....	48	18	2		1.5	41
Suggested requirements and expected production	.....	100	30	15	10	1.5	90

bor than a flock of 50 hens. A flock of 100 hens culled to eliminate non-layers should produce at least 750 dozen eggs per year when given the quantities of feed suggested. Some feed would be obtained from the fields. The grain fed could consist of corn and sorghum seed, though corn is better and often lower in price. The laying mash could consist of ground corn and ground oats, though bran and shorts could profitably be added. (a) The chickens should have all the skim milk they will drink or the animal protein needed should be provided by adding meat scrap to the mash mixture. On many farms skim milk for 100 hens would not be available.

The production expected for this ration is double the average production for the area but should be easily attained by most producers, and would make the poultry enterprise a valuable part of the farm business.

Expected Prices of Marketable Products

Farm returns in any given year depend partly on prices received, and for farms on which cotton is the chief source of income, farm profits will closely follow the price of cotton unless yields are exceptionally low or high. The farmer in planning his year's operation often considers only the relative returns from different enterprises for the past year and gives little attention to the probable price at harvest time.

Prices do, however, fluctuate around a mean or normal value, and the prices of different commodities tend to have a certain definite relation. This normal price of all products may never exist under actual conditions, yet the normal price of a product should be a better guide to the expected future price than the price of the last year or the price prevailing at planting time.

Farmers should take into account the seasonal variations in prices together with price trends over longer periods. For perishable products this is especially true and it is the expected price at the time of marketing on which the producer should base his operations.

A complete analysis of prices of Mississippi products cannot be made here but approximations of expected prices based on prices of previous years, trends of prices and the long time outlook for particular commodities are given

TABLE 18—ESTIMATED PRICES, CHOCTAW COUNTY, MISS.

PRODUCTS TO BE SOLD			EXPENSE ITEMS		
Item—	Unit	Price	Item—	Unit	Price
Cotton	lb.	$ .175	Cotton Seed Meal	ton	$40.00
Cotton Seed	ton	32.00	Bran	ton	35.00
Corn	bu.	1.00	Cow Peas	bu.	2.00
Oats	bu.	.65	Soy Beans	bu.	2.50
Sweet Potatoes	bu.	1.00	Lespedeza Seed	bu.	4.00
Loose Hay	ton	15.00	FERTILIZERS—		
Lespedeza	ton	20.00	(1) Home mixed 8-6-4	ton	36.40
Hogs	lb.	.085	Nitrate of Soda	ton	59.00
Chickens	lb.	.20	Acid Phosphate 16%	ton	18.00
Eggs	doz.	.22	Sulphate Potash	ton	38.00
Milk, 4%	cwt.	2.00	Labor	day	1.50
Butter Fat	lb.	.38			
Cows	head	30.00			

(1) Home mixed 300 pounds acid phosphate; 225 pounds nitrate of soda; 50 pounds sulphate of potash.

Mississippi Experiment Station Bulletin 241—"Cotton, Fertilizers and Varieties, 1926.

(a.) Helps for Mississippi Poultry Raisers.—Mississippi Extension Bulletin No. 26.

in table 18. These prices are used in this bulletin in estimating farm returns for farms under different systems of management. It is not expected that these prices will prevail at any one time, but it is believed that they will represent relative values of products from farms in this section of Mississippi. (1).

On most farms cotton is the first consideration and corn, hogs, hay , dairy cows, and truck crops make up the alternative enterprises. The price received for cotton has an important bearing on farm income. Figure 12 shows the monthly price of cotton and cotton seed since 1921. Cotton prices were considered to be relatively high during 3 of the six years. During this period the price of cotton was high enough to bring about a great expansion in cotton acreage. For the purpose of this bulletin the price is taken slightly lower than the average for the 6-year period.

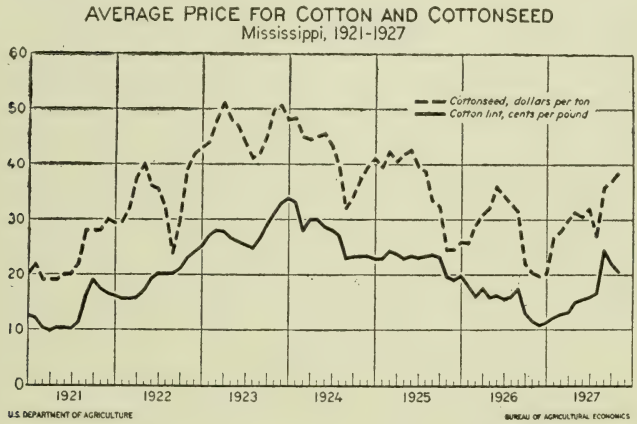


Fig. 12—The seasonal variation in cotton seed prices is more marked than the variation in prices for lint, but in general, the price trends are similar

SYSTEMS OF FARMING

Income per farm in this area is low when compared to that in many sections of the United States. Most of the farms are family operated, and the acres cultivated are insufficient to give large returns. The fact that cotton the most important cash crop, requires a large amount of hand labor limits the acreage which can be grown by the family. The topography and the nature of the soil generally make very large units of machinery impractical so that the acreage of crops can not readily be extended. The low natural fertility of the soil limits the crop yield and in many cases the return per acre is low. Increases in income per family will come about through increasing the efficiency of production, or in enlarging the farm business or both.

More efficient production than the average existing in the area is essential for providing a higher standard of living. Good crop yields should not require much more labor than low yields. Efficient livestock production can be obtained with little increase in the time required to care for the livestock.

(1) Data are drawn from: (a) U. S. D. A. Statistical Bulletin 16—"Prices of Farm Products Received by Producers, South Atlantic and South Central States."
(b) U. S. D. A. Misc. Circular 101.—"The Agricultural Outlook for 1927."
(c) Prices received by Choctaw County, Mississippi, farmers as reported on survey and records for 1920 to 1926.
(d.) Current issues of "Weather Crops and Markets Supplement."

Judicious use of fertilizer on crops and intelligent feeding of livestock should lead to higher yields per unit and a more economical production.

The size of the farm business also is a limiting factor in farm profits. Where cotton is the chief crop it often determines the size of the farm business. Other crops and livestock serve only to contribute to cotton production. The acreage of cotton which can be handled by the available labor, and the feed crops for work stock and livestock which contribute to the family living often make up the extent of the farm enterprises. On many farms such enterprises as dairy cows, hogs, poultry, or truck crops could be increased without reducing the cotton produced and would increase farm profits materially. On most farms the land area is not the limiting factor in production although the land in use is in many cases the most productive land of the farm. Much of the land now lying out could be brought into cultivation again or developed into good pastures. Where available labor is the limiting factor to increased production, additional crops are grown by a share cropper rather than with wage labor.

A combination of the farm enterprises which will increase the production of minor crops and livestock products without a corresponding decrease in the leading cash crop usually will increase the net returns. To obtain this combination would mean an increase in crops or livestock which would be cared for with no serious conflict in the demand of the cotton crop for labor. A cropping system designed to conserve soil fertility should reduce the expense for fertilizers, and where additional crops can be utilized by livestock the contribution to soil fertility would be increased and a more uniform distribution of labor obtained.

Many farmers increase their income by work off the farm during slack seasons. Profitable enterprises which would utilize this spare time would provide work on the farm during the same period and would insure an opportunity to utilize this time.

Figure 13 shows distribution of labor on a typical farm in this section.

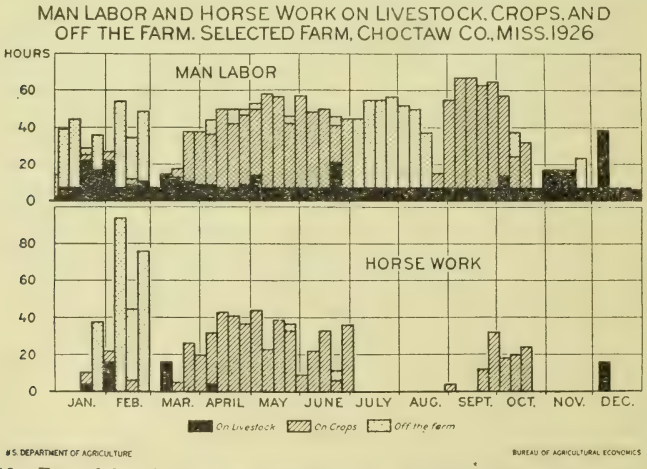


Fig. 13—Farm labor is heaviest from April to June, and from September to October 15. This typical distribution allows time for outside labor during the winter and mid-summer. A farm so organized as to provide steady employment on the farm throughout the year is usually more desirable.

An increase in yield which would produce the same quantity of cotton on a smaller acreage would release land for the growing of other crops which might be marketed or fed to livestock.

With these points in mind and in view of information brought out in a study of the records taken in the area for a period of years, with additional data from other studies and from the results of experiments, outlines for the organization of farms are suggested. These suggested systems are adapted from systems now in operation in the section. Such changes as have been made are in line with conclusions brought out by the study, and those contained in reports of experiments.

The cropping systems suggested are such as will offer a distribution of man labor, produce crops which can be readily utilized, and conserve soil fertility. They have been shown to be well adapted to the section.

In estimating farm returns it is necessary to assume a given price for products sold. The prices used are such as appear probable for the quality of products common to the area. Considering a period of years a particular effort has been made to maintain a normal relation between the prices of the different commodities so that the comparison of returns from the different organizations will show the relative profitableness of each over a long period of time.

Suggested Systems of Farming for Farm With Approximately 40 Acres of Crop Land and Additional Pasture

A farm with between 40 and 50 acres of land in crops and improved pastures is as much as one man can conveniently care for. The farm would be organized with as much cotton as one man with some additional family labor could tend and pick and such other crops and livestock as could be cared for without an undue conflict with the cotton. A system of farming for a farm with 40 acres of crop land is described in tables 19 to 23 (a).

The farm would produce cotton, corn, some hay, and in addition to the necessary work stock would keep a few cows, hogs and poultry to produce products for home consumption or for market. The system as outlined would be applicable to localities in which a market for butter fat was available and on farms having approximately equal amounts of cotton and corn land. Where both markets for cream and whole milk are available the advisability of selling to one or the other depends on the prices offered and the possibilities of utilizing the skim milk on the farm.

Where the quantities of fertilizer recommended are used the cropping system given in table 19 should normally produce 6 bales of cotton, 3 tons of cotton seed, 300 bushels of corn, 180 bushels of oats, and approximately 12 tons of hay and straw. Since the nature of the soil and arrangements of fields is such that a definite rotation is unlikely to be practiced, a winter cover crop of oats, rye, or where the crop is adapted, vetch is suggested. The winter cover crop would not only furnish some winter pasture, and a green manure crop to be plowed under in the spring, but would also tend to hold the unused fertilizer of the preceding crop. It is estimated that about one-third of the

(a) The authors are not unmindful of the oft repeated slogan, "Food and Feed First"; but since it has been shown that ample food and feed can be produced without reducing cotton acreage, and since cash is essential to high living standards, the cash crop is given precedence.

fertilizer applied to a crop remains in the soil as residue, but without a cover crop on the land much of this fertility would be leached or washed away during the winter. The winter pasture provided would reduce the amount of hay required by the stock.

TABLE 19—CROP REQUIREMENTS AND PRODUCTION FOR SUGGESTED SYSTEM WITH 40 ACRES OF CROP LAND (System 1)

Crop—	Acres	Acre Yield	Total Production	Fert. Used Tons	Man Labor, Hrs.	Horse Work Hours	USE OF CROP			Value Sold Dollars
							Feed,	Seed,	Sale,	
Cotton (lint)	12	250 lbs.	3,000 lbs.	3.	1,104	476			3,000	525
Cotton (seed)		500 lbs.	6,000 lbs.					500	5,500	88
Corn	12	25 bus.	300 bus.	1.5	456	420	283	2	15	15
Oats (grain)	6	30 bus.	180 bus.	.6	90	84	120	60		
Oats (straw)		.5 ton	3 tons				3 tons			
Lespedeza	3	1 ton	3 tons		36	54	3 tons			
Lespedeza	3*	1 ton	3 tons		36	54	3 tons			
Soy Beans	3*	1.2 ton	3.6 tons		100	100	3.6 tons			
Improved Pasture	7									

*Second crop.

A heavier yield of oats would undoubtedly be obtained from low land, but with the addition of the nitrate fertilizer good yields should be obtained on upland and the rotation of cotton and oats would be possible. After the oats are harvested a crop of lespedeza hay on low land or soybean hay on upland could be obtained with no application of fertilizer other than that not utilized by the oats. The 3 acres of lespedeza seeded with the oats should give a good hay crop following the oats and would reseed itself for a hay crop the following year. If allowed to reseed, the lespedeza would remain on the land for a longer time than one year if desirable. Lespedeza seeded on upland, when oats followed cotton, would be used for pasture.

This cropping system should normally produce a small surplus of grain over the requirements of livestock on the farm. Expected cash receipts from the sale of crops are $628.

Because the dairy industry in the country is as yet undeveloped the dairy herd is small and heavy production is not expected. A herd of 5 cows kept for milk with one heifer and one calf for replacement are suggested. Unless the stock is of exceptional quality it will rarely pay to raise any except the best heifer calves. Veals from the small dairy breeds are not readily marketable and they will not pay for milk consumed. Two mules or horses for farm work, a sow with one litter of pigs each year, and 100 head of poultry would also be kept.

The quantity of feed used and the method of distribution is given in table 20. Practically all the feed grown on the farm with the exception of the cotton seed would be fed to livestock. In addition to the farm raised feed, cotton seed meal, tankage, and mash for the poultry would be purchased. Cotton seed might be advantageously exchanged for cotton seed meal. Where winter pasture is available less hay than that allowed here would be required and with no change in the cropping system some surplus could be sold.

The production of livestock and livestock products and the use to which these are put is given in table 21. Dairy products, meat, and eggs would be

provided for home use and in addition butter fat, some pork and poultry products would be for sale. Expected cash receipts from the sale of livestock and livestock products are $613.

TABLE 20—FEED FOR LIVESTOCK, SUGGESTED SYSTEM WITH 40 ACRES OF CROP LAND (System 1)

Live Stock	Head Number	FEED						
		Corn bus.	Oats bus.	Cotton S. Meal lbs.	Bran lbs.	Tankage lbs.	Hay or Straw tons	Skim Milk lbs.
Mules	2	65	50	.....	.....	.....	3.	.....
Cows	5	54	48	1,500	.....	.....	7.5	.....
Heifers	1	4	5	150	.....	.....	1.0	.....
Calves	1	3	5	150	.....	.....	.25	3,000
Hogs	8	111	.....	.....	.....	400	.....	4,000
Poultry	100	46	12	.....	2,000	.....	.....	9,000
Total	.....	283	120	1,800	2,000	400	11.75	16,000

TABLE 21—PRODUCTION OF LIVESTOCK AND LIVESTOCK PRODUCTS (System 1)

Live Stock	Number	Unit Production	Total Production	DISPOSITION			
				Used in Home	Fed Lbs.	Sale	Sale Value
Cows	5	200 lbs Butter fat	1 cow butter fat 1,000 lbs	150 lbs.	18	1 Cow 832 lbs.	$ 30 333
Hogs	1 sow 7 pigs	.....	pork 1,500 lbs.	700 lbs	....	800 lbs.	88
Poultry	100	7.5 dozen eggs	750 doz eggs 250 lbs. meat	150 doz. 100 lbs.	....	600 doz. 150 lbs.	132 30

Making no allowance for miscellaneous receipts such as the sale of wood or lumber or receipts from work off the farm the expected gross returns from crops and livestock are $1,241.

Current operating expenses would be higher on this farm than for many farms in the area as they are operated. The cost of fertilizer is somewhat greater, more supplementary feed is purchased, and such expenses as feed grinding, threshing, and breeding fees would be increased. The expected costs of the most important items of expense are given in table 22. The total operating cost of farm including taxes should be about $663.

TABLE 22—SALES AND OPERATING EXPENSES FOR SYSTEM WITH 40 ACRES OF CROP LAND (System 1)

Sales—

Crops (from table 19) $628
Livestock (from table 21) 613

Total Sales $1241

Crop Expenses—

Fertilizer

Cotton 3 tons at $36.40 ..... $109
Corn 1.5 tons 65

Oats .6 tons	36
Seed—1/3 cotton seed, 5 bu. @ 2.*	10
Lespedeza 3 bu. @ 4	12
Soy beans 3 bu. @ 2.50	8
Threshing 100 bu	18
Ginning costs	30
Purchased Feed—	
Cotton seed meal 1800 lbs. @ 2	36
Tankage 400 lbs. @ 4	16
Bran 2000 lbs. @ 35	35
Oyster shell 200 lbs. @ 1.00	2
Miscellaneous Expenses—	
Grinding 3.5 tons @ 3.00	11
Breeding fees	15
Other farm expenses	50
Taxes—	210
Total Expense	$ 663
Net Return	$ 578

*Assumed that cotton seed will be renewed every third year.

The difference between cash receipts and expenses with this system under usual conditions would be about $578, and would represent the normal return to the operator. To this income should be added the value of products furnished

TABLE 23—EXPECTED RETURNS FROM FARMS WITH APPROXIMATELY 40 ACRES IMPROVED LAND, WITH DIFFERENT SYSTEMS OF FARMING

	SYSTEM No. 1 Suggested System With Cotton and Dairy Products		SYSTEM No. 2 As Operated in 1926 Cotton and Corn		SYSTEM No. 3 Suggested System With Cotton and Sheep	
Size of farm (acres)	80		71		80	
Crop land (acres)	35		35		33	
Improved pasture (acres)	10		.....		10	
Woods pasture and farmstead (acres)	35		36		37	
Total investment. Dol.	$3,500		$3,100		$3,500	
CROPS GROWN—	**Acres**	**Production**	**Acres**	**Production**	**Acres**	**Production**
Cotton	12	3,000 lbs. lint 6,000 lbs. seed	18 (1)	3,750 lbs lint 7,000 lbs. seed	12	3,000 lbs. lint 6,000 lbs. seed
Corn	12	300 bushels	13	325 bushels	12	325 bushels
Oats	6	180 bushels	.....	.....	6	180 bushels
Hay	9 (2)	9.6 tons	2	2.4 tons	9 (2)	9.6 tons
Truck crops	2	family use	2	family use	2	family use
LIVESTOCK—	No.—		No.—		No.—	
Work Stock	2	farm work	2	farm work	2	farm work
Cows	5	1,000 lbs. fat	2	family use	2	family use
Young Cattle	2	1 cow	.....	.....	.....	.....
Hogs	8	1,500 lbs. pork	8	1,500 lbs. pork	8	1,500 lbs. pork
Poultry	100	750 doz. eggs 250 lbs. poultry	42	315 doz. eggs 105 lbs. poultry	150	925 doz. eggs 375 lbs. poultry
Sheep	.....	.....	.....	.....	37	30 lambs 148 lbs. wool
Receipts from Crops		$628.00		$848.00		$653.00
Receipts from Livestock		613.00		112.00		675.00
Total Receipts		1,241.00		960.00		1,328.00
Cash Expenses		663.00		524.00		704.00
Net Return		578.00		436.00		624.00

(1) 6 Acres by share cropper.
(2) 6 Acres are second crop.

the home which would be equivalent in value to about $450, during the year. The returns from this system are compared with estimated returns from alternative systems in table 23.

The crop and livestock organization with system "2" in table 23 is that of one of the most successful small farms on the Choctaw County route in 1926. Cotton and corn were the important crops grown and with the exception of a small quantity of pork no livestock or livestock products were sold. This farm had a total area of 70 acres, of which 40 acres were suitable for cultivation and 35 acres were in crops in 1926. The crops consisted of 18 acres of cotton, 13 of corn, 2 acres of pea hay and 2 acres of miscellaneous truck crops for family use. The operator cared for all crops except 6 acres of cotton which was grown by a share cropper. The farmer operator provided one-half the cash expenses for this crop and obtained one-half of the product. With the production per unit used in estimating returns with system 1 the cotton acreage on farm 2 would give the operator 7.5 bales of cotton lint and 7000 pounds of seed for sale. The corn crop would give a surplus of approximately 80 bushels over the requirements for feed (1). No dairy products were sold from the farm and since no particular effort was made to obtain a high production per cow the feed given is less than for the herd with system 1. The pork and poultry enterprises would produce a small surplus over the products which would be used by the family.

The quantity of feed given each class of livestock differs somewhat from that for the suggested system. For instance the records show that the cows on this farm received more cotton seed meal, and cotton seed hulls but less grain and hay than the suggested ration. The pork produced, equivalent to about 1600 pounds of live hogs, required about the same quantity of feed as the suggested ration but used more corn and no protein supplements.

Adjusting production on this farm by applying suggested requirements and production to the acres of crops and number of livestock kept and applying the prices assumed in estimating returns with system 1 makes a direct comparison of the two systems of farming possible.

Farm income is principally derived from the sale of cotton and cotton seed. Crop receipts including the sale of surplus corn equaled $848, while receipts from the livestock enterprises, poultry and hogs, would make $112 more. From this income of $960 the cash expenses for fertilizer, purchased feed, taxes, services, and miscellaneous expenses amounting to approximately $524 should be deducted. The resulting farm income is $436 as compared to $578 for the suggested system 1. The value of products used by the family is assumed to be the same with each system.

System "2" may be criticized for including so small an acreage of legumes in the cropping system, and making no provision for a winter cover crop. The livestock in system "1" together with the use of cover crops should aid in maintaining fertility and humus in the soil and consequently reduce the risk of low crop yields. System "2" is dependent on the yield of corn for feed whereas a small acreage of oats would reduce the risk of a short feed crop during unfavorable years. The income of system "2" is dependent on good

(1) The production of crops, quantity of fertilizer used, feed consumed by livestock, and production of livestock products were worked through as in tables 19 to 22 for farm 1, but to avoid repeating the form of these tables only the final estimates are given in table 23.

cotton yields and good cotton prices, and while the income may be larger for especially favorable years, the operator must expect some years of low yields or low prices when his farm income will be very much reduced.

System "3" might be profitably put into practice in sections where a market for dairy products is not available but where pork or lambs could be readily sold. The system as outlined has 12 acres of cotton and 12 acres of corn, 6 acres of oats and 9 of hay. The cropping system is similar to that of system "1" and equal production per acre has been assumed.

The livestock consists of horses or mules for farm work, cows for dairy products to be used in the home, poultry, hogs, and a small flock of sheep. Although very few sheep are kept in the area at the present time, wool production was once a common enterprise on many farms of the area, and in view of present prices for wool and lambs, and the outlook for prices, this enterprise might be reintroduced on some farms. A small flock of sheep would utilize a part of the roughage and pasture, and would give some returns from the wool clip and from the sale of Spring lambs. Spring lambs from this area should be suitable for market weighing about 70 to 80 pounds by early summer. The flock of sheep would require some attention during lambing season, and on most farms in the area the sheep enterprise would require a certain amount of fencing.

Estimated returns from this system are given in table 23 under number "3". With sales of 6 ewes, 24 lambs, and 148 pounds of wool from a flock of 37 sheep and the sale of surplus poultry and pork products the returns from the sale of livestock would be $675. This with crop sales of $653 would give a gross income of $1,328, from the farm. Expenses for fertilizer, feed, taxes, services, etc., are estimated at $704. The farm income with no deduction for extra labor would be $624, as compared to $578, for the farm first suggested. Allowance for products used in the home has been made and the value of these products should be equal on the different systems described.

Suggested Systems of Farming for Farms with Approximately 70 Acres of Improved Land with Additional Woodland and Pasture

A farm with 60 or more acres in cultivation in this section is larger than a one man unit. With the proportion of crop acres in corn and cotton typical of the area the farm could be operated by one man and additional family labor equivalent to the labor of one man. Typically the farm would be operated by one man, and crops in excess of those which could be cultivated by one man would be let out to croppers. The proportion of wage to share crops would depend quite largely on the amount of unpaid labor available on the farm. Some farms larger than this are operated as a family unit.

Formerly many farmers in the south did not have the advantage of a good market for dairy or other livestock products. The development of the dairy products industries has placed a market for whole milk within hauling or shipping distance of many farmers and nearly all farmers can find a ready market for cream. System 4, outlined in table 24 gives the organization of a farm with 70 acres of crop land on which dairying is combined with cotton.

A system of this type would require some labor other than that of the operator and would use an additional man for the greater part of the year. The estimated income is based on crop yields and livestock production sug-

gested as standard and good practice in crop and livestock production is assumed.

TABLE 24—EXPECTED RETURNS FROM SYSTEMS WITH APPROXIMATELY 70 ACRES IMPROVED LAND, WITH DIFFERENT SYSTEMS OF FARMING

	SYSTEM No. 4 Suggested System Cotton and Dairy Products		SYSTEM No. 5 As Operated in 1926—Cotton and Corn		SYSTEM No. 6 Suggested System Cotton and Sheep	
Size of farm (acres)	120		120		120	
Crop land (acres)	50		51		50	
Improved pasture	20		15		20	
Wood, stump land and farmstead	50		54		50	
Total investment	$5,500		$5,670		$5,500	
CROPS GROWN—	**Acres**	**Production**	**Acres**	**Production**	**Acres**	**Production**
Cotton	15	3,750 lbs. lint 7,500 lbs. seed	29 (1)	4,625 lbs. lnt. 9,750 lbs. seed	15	3,750 lbs. lint 7,500 lbs. seed
Corn	15	375 bushels	16 (2)	325 bu.	15	375 bu. grain
Oats	10	300 bushels 5 T. straw			10	300 bu. grain 5 T. straw
Lespedeza	10	10 T. hay	3	3 T. hay	10	10 T. hay
Soy Beans	8	9.6 T. hay	1	1.2 T. hay	8	9.6 T. hay
Truck Crops	2	home use	2	home use	2	home use
LIVESTOCK—	No.—		No.—		No.—	
Work Stock	3	farm work	3	farm work	3	farm work
Cows	10	2,000 lbs. B.F.	2	family use	2	family use
Young Cattle	4	2 cows				
Hogs	8	1,500 lbs. pork	2	327 lbs. pork	8	1,500 lbs. pork
Poultry	100	750 doz. eggs 250 lbs. poultry	81	607 doz. eggs 202 lbs. poultry	200	1,500 doz. eggs 500 lbs. poultry
Sheep					74	60 lambs 296 lbs. wool
Receipts from crops	$ 768.00		$1,021.00		$ 888.00	
Receipts from livestock	1,008.00		121.00		978.00	
Total receipts	1,776.00		1,142.00		1,866.00	
Cash expenses	912.00		707.00		1,012.00	
Net returns	864.00		435.00		854.00	

(1) Nineteen acres grown by share cropper.

(2) Six acres grown by share cropper.

Fig. 14—Six hundred pounds per acre of fertilizer analyzing 8-6-4 is responsible for the difference in the appearance of the cotton on the right and the left of the picture. The difference in yield was 1,070 pounds of seed cotton and the difference in value after paying for the fertiiizer was $43.22.

Fifteen acres of cotton receiving 500 pounds of 8-6-4 fertilizer should produce 250 pounds of lint and 500 pounds of seed per acre giving a total production of 7½ bales of lint and 3 3/4 tons of cotton seed. Fifteen acres of corn receiving 250 pounds of fertilizer per acre could be expected to yield 25 bushels per acre. Ten acres of oats cut for grain fertilized with 200 pounds of nitrate of soda should return 300 bushels of grain and 5 tons of straw. A winter cover crop of oats for cotton and corn land to provide winter pasture and prevent wasting of fertilizer residue is suggested. Lespedeza seeded with oats on good land should yield a crop of hay following the oats. The lespedeza sowed on thin upland would be utilized for pasture. Soy beans on upland following oats would also produce a crop of hay and leave the land for a cultivated crop the following year. In addition to the hay following the oats, 5 acres of reseeded lespedeza will be required for hay. By using lespedeza pasture on upland the cotton land may be alternated with legumes.

Under this cropping system an annual production of 3750 pounds of lint, 7500 pounds of cotton seed, 375 bushels of corn, 300 bushels of oats, 19 tons of hay and 5 tons of straw should be made normally. Of this production only the cotton lint and seed would be marketed. The feed crops would be utilized by livestock on the farm.

The livestock would consist of 3 mules for farm work, 10 head of milk cows, 4 head of young cattle, 100 head of poultry, and pigs to produce approximately 1500 pounds of pork. In addition to the feed grown on the farm the livestock would require 2 tons of cotton seed meal and 1000 pounds of poultry mash. This supplement would balance the feed available on the farm.

Ten cows producing 4000 pounds of 5% milk each would produce 1890 pounds of butter fat in addition to the milk used in the home and fed to calves. Where cream is sold the skim milk would provide sufficient protein feed for the poultry and hogs. Unless the cows were of exceptional quality it would not be profitable to keep young stock except those required for replacement of the dairy herd. Presumably 2 calves kept each year would allow the sale of 2 cows or heifers. With the normal production of butter fat, pork, and poultry, receipts from the sale of livestock and livestock products would amount to $1008 annually. This, with the $768 from the sale of cotton and seed would give an expected cash income of $1776.

Current expenses for fertilizers, feed, seeds, breeding fees, feed grinding, and taxes would be approximately $912 leaving a net cash income to the farm and labor of $864. To obtain the net production of the farm the value of products furnished the home estimated at $450 should be added.

Hired labor equivalent to one man for 6 months at $30 per month would reduce the return to the operator by $180.

Share cropping is more common than hired labor on crops, and with a farm of this type one man could care for the livestock and feed crops with perhaps some extra labor during haying. With the 15 acres of cotton grown on a share basis the operator would receive ½ of the crop and would bear ½ of the cash expense. With no change in practice the normal net return to the operator would be $548, where the cotton was grown by a cropper.

System "5" in table 24 shows the system of farming followed on one of the most successful 120 acre farms on which records were kept in 1926. On this farm no effort was made to produce a surplus of livestock or livestock

products. Dairy products and pork were produced for home use only. Two-thirds of the cotton and one-third of the corn was grown on a share basis. Ten acres of corn, 10 of cotton, 3 of lespedeza and 1 of pea hay were grown by the operator, while 19 acres of cotton and 6 of corn were grown by share croppers. The farm had 3 head of work stock, 2 cows, hogs to produce 327 pounds of dressed pork, and 81 chickens.

This system in 1926 gave a farm return of $914, including the value of products furnished the home and $480 received from labor off the farm.

With the expected crop yields the farm would produce 4625 pounds of cotton and 9000 pounds of cotton seed for the operator's share and 107 bushels more corn than would be required for livestock. Returns from crop sales at normal prices would be $1021. A small surplus of eggs and poultry would add $121 to the cash receipts. Normal current expenses for the operator's share of fertilizer on corn and cotton, cost of seed, purchased feed, taxes, and miscellaneous expenses would total $707. The expected net income would be $435 not including farm products used in the home or receipts from outside labor.

The expected farm return from this system plus the receipts from outside labor is approximately the same as that of system 4. In arriving at crop production the amount of fertilizer used and crop yields were considered the same for both systems, yet over a period of years yields would be more certain with system 4. The greater use of legumes, cover crops, and rotating pasture in system 4 would tend to improve the soil and good crop yields would be more easily attained. The risk of low yields would be reduced, and where the system was practiced for a period of years, should result in higher average yields than those assumed or would allow a reduction in cost of fertilizer.

Where the farm income is derived from only one source, profits are dependent on the price and yield of the single product, and returns will fluctuate widely from year to year. In this case returns in years of good prices and yields would be high, while other years of low yields or low prices small profits

Figure 15—Cotton, feed and livestock may form the basis for a safe and profitable farming system. The field here is used as a feed lot during the winter, thus saving manure with little effort.

could be made. The income with system "4" would be more constant since dairy production and prices may be good and compensate for low returns from cotton in poor cotton years. Some years the return would be less since it is unlikely that exceptional profits could be made on two commodities the same year. Receipts from outside labor with system "5" made up a large share of the income, and these receipts depend on the opportunity for the operator to find profitable employment during slack seasons. This opportunity may not be open to all farmers and enterprises which will allow remunerative labor on the farm are more desirable.

Other enterprises than dairying may be worked into the farming system with good results. In some sections a market for dairy products may not be available and other crops or livestock adapted to the particular farm may be developed. System "6" outlined in table 24 shows the estimated returns from a farm of 70 improved acres on which sheep would be kept. With the same cropping system and production outlined in system "4" 60 ewes and the lambs would not use all of the feed grown, and a small surplus of hay could ordinarily be sold. Receipts from livestock and livestock products would under usual conditions be somewhat less, but with lower expenses the farm income would be approximately the same as in "4". Since sheep require less labor than dairy cows, the flock of poultry might be increased.

With sheep the farm return would depend to some extent on the ability of the operator to care for the flock, and while the flock would make good use of roughage and pasture, the sheep must be carefully tended. In sections where sheep are not commonly grown, dogs may cause some losses. One disadvantage of sheep raising is that on most farms the establishing of a farm flock would require an immediate outlay of cash for adequate fencing.

Systems of Farming on Larger Farms

On farms larger than one-man units much of the land is cultivated by share croppers. The land actually operated by the owner is usually equivalent to a small farm, and is organized as such. The organization of the larger farms depends so much on the individuality of the owner and the croppers that typical systems can not readily be described. For the most part the larger farms grow cotton and corn, and it would be difficult to work in other enterprises on land except that operated by the owner.

TABLE 25—CROP PRODUCTION ON FARM WITH 120 IMPROVED ACRES

Crop	Acres	Acre Yield	Total Production	Fertilizer Tons	Disposition of Crops			
					Feed	Seed	Sale	Sale Value
Lint	25	250 lbs.	6,250 lbs.	6.25			6,250 lbs.	$1,094
Seed		500 lbs.	12,500 lbs.			1000 lbs.	5.75 T.	184
Corn	25	25 bu.	625 bu.	3.125	591 bu.	4 bu.	30 bu.	30
Grain	15	30 bu.	450 bu.	1.5	344 bu.	106 bu.		
Straw		0.5 T.	7.5 tons		7.5 tons			
Lespedeza (1)	20	1 T.	20 tons		20 tons			
Soy Beans (2)	15	1.2 T.	18 tons		18 tons			

(1) 10 acres of lespedeza second crop following oats.
(2) 5 acres of soy bean hay second crop following oats.

A combination of cotton and dairy products for a farm of 120 cultivated acres is described in tables 25 to 28. This system is essentially an expansion of the types discussed as systems 1 and 4. However, because of its larger size the tables showing the distribution of crops and livestock are given.

Table 25 shows the crop requirements and production and the use made of the crops. Twenty-five acres of cotton using 6¼ tons of 8-6-4 fertilizer should produce 12½ bales of cotton lint and 5¾ tons of seed for sale. As wage cotton the returns from this crop should be $1,278, however, the crop would probably be grown on a share basis. Twenty-five acres of corn and 15 acres of oats for grain would just about meet the needs of livestock for grain crops. The small surplus of grain is negligible. Ten acres of lespedeza following oats and 10 acres of second-year lespedeza should produce 20 tons of legume hay. This with 5 acres of soy bean hay following oats, 10 acres of early soy bean hay and the oat straw, would meet the expected requirements for roughage. Oats to seed a winter cover crop on all cultivated land is provided, and this crop available for winter pasture would reduce the requirement for hay.

The distribution of the feed to livestock is given in table 26. These quantities are based on the suggested requirements for livestock production. Since a market for whole milk is assumed, the milk fed to calves should be kept as low as possible. Prepared calf meal fed to calves with a small quantity of whole milk will keep the cost of rearing calves at a low figure, however, calves must be of good stock before it will be profitable to raise them on milk and feed. Some milk must be fed, and with milk testing 5 per cent fat, an allowance of 600 pounds per calf means a cost of about $15 per calf for milk alone. Calves from cows producing no more than 200 pounds of butter fat annually had best be disposed of at birth. With no skim milk for feed, tankage for hogs and meat scrap for poultry should be provided.

TABLE 26—FEED FOR LIVESTOCK—FARM WITH 120 IMPROVED ACRES

Kind of Livestock—	Number	Corn, Bu.	Oats, Bu.	Cottonseed Meal, Lbs.	Mill Feed, Lbs.	Tankage, Lbs.	Milk Lbs.	Hay and Straw, Tons
Mules	4	185						6.
Cows	20	214	188	6,000				30.
Heifers	5	18	47	1,500				5.
Calves	5	18	47	1,500	1,000		3,000	1.
Bull	1	9		500				2.
Hogs	8	111				500		
Poultry	100	36	62		1,000			
Total		591	344	9,500	2,000	500	3,000	44.

The expected production of livestock and products and the use to which these are put are shown in table 27. Milk testing 5 per cent is valued at $2.50 per hundred pounds. This price is based on a normal price of $2.00 for 4 per cent milk and 5c per hundred weight of milk for each additional .1 per cent of fat. The amount of products used in the home should be sufficient for one family. Expected receipts from livestock enterprises are $2,268.

TABLE 27—PRODUCTION AND USE OF LIVESTOCK AND LIVESTOCK PRODUCTS—FARM WITH 120 IMPROVED ACRES

	No.	Unit Production	Total Production	Disposition of Product			Value of Sales
				Used in Home	Fed, lbs.	Sold	
Cows	20	4,000 lbs. milk	80,000 lbs.	1,500 lbs	3,000	75,500 lbs.	$1,888.00
Young Cattle	10		5 cows or heifers			5 head	150.00
Pork	8		1,500 lbs. live wt.	700 lbs.		800 lbs.	68.00
Poultry	100	7.5 doz eggs	750 doz.	150 doz.		600 doz.	132.00
		2.5 lbs. meat	250 lbs.	100 lbs.		150 lbs.	30.00
Total livestock sales							$2,268.00

A brief financial summary of the farm business is given in table 28. Total cash receipts under usual conditions should equal $3,576. Expenses including all fertilizer, feed and seed purchased, taxes and miscellaneous expenses are estimated at $1,888. To operate the farm as described would probably require the labor of one man for the greater part of the year and the labor of a second man during the cropping season in addition to the labor of the operator. Allowing $800 for hired labor would give a farm income of $888 to the operator for his own labor and the use of his land. This income figure does not include products furnished the family which would be approximately $450.

TABLE 28—FINANCIAL SUMMARY ON 120-ACRE DAIRY FARM

Investment		$10,000
Receipts—		
Crops	$ 1,308	
Livestock	2,268	
Miscellaneous		
Total		$ 3,576
Expenses—		
Fertilizer	$ 453	
Feed	413	
Seed	90	
Threshing, ginning, grinding	182	
Miscellaneous	150	
Taxes	600	
Total		$ 1,888
Difference		1,688
Hired labor		800

Probable Effects of Variations in the System of Farming

Direct expenses of fertilizer and labor could be reduced by letting the cotton ground to a cropper tenant. This adjustment would decrease the returns from cotton 50 per cent, but would also reduce the expense for fertilizer on cotton by 50 per cent, and would eliminate much of the hired labor during the summer. Labor on cotton at 100 man hours per acre and charged at 15c per hour would be a total cost of $375. One-half of the cost of fertilizer on cotton would be $114. With the same yields and prices used in estimating the farm income in table 27 the expense would be reduced $489, and the receipts $639. The operator would, however, be relieved of part of the management of the crop and would be carrying only one-half of the risk.

With 20 cows and 10 head of young cattle the operator might find it advisable to build a silo and substitute silage for a part of the roughage in the cattle ration or to supplement pasture and reduce the acreage required. Five acres of corn land planted to Texas seeded ribbon cane should produce 60 tons of silage. This silage would replace approximately half of the hay in the cattle ration and would reduce the hay requirements by about 20 tons. With silage the amount of cotton seed meal in the ration should be increased in order to balance the ration, and with 5 acres less of corn some additional grain might be purchased.

The sorghum for silage might replace the soy beans following oats, and would thus more nearly balance the feed production with feed requirements. In this area approximately 10 tons of hay more than is needed would be produced.

Where no market for whole milk is available cream would be sold and the skim milk remaining on the farm utilized by poultry and hogs. The skim milk would then replace the tankage and meat scraps purchased and to some extent would reduce the amount of corn required for pork production. In order to utilize the skim milk, pork production could be doubled, which would in turn increase the amount of corn required for hogs, and might call for an increased acreage of corn. With butter fat at 38c per pound, 5 per cent milk would be worth $1.90 per cwt. as compared to $2.50 taken as the expected price for whole milk. For hog feeding 100 pounds of skim milk is figured roughly as equal in value to ½ bushel of corn. With corn at $1.00 per bushel the skim milk would be valued at approximately 50c per 100 pounds. Each 100 pounds of 5 per cent milk from which 25 per cent cream is sold would return 80 pounds of skim milk for feeding which would have a value of about 40c for hog feed. The total value of the milk and cream would be approximately $2.30 per cwt. The cost of hauling would be less for cream than for whole milk. The relative merits of selling cream or whole milk where markets for both are available may be determined by using actual prices and conditions.

The Choice of Enterprises

The systems of farming previously described were set up to show the relation of several enterprises in the farm business and to point the way to improved organization on Mississippi farms. Farm management has here been treated in a very general way and the results are strictly applicable only when the conditions assumed do exist. The farmer who is looking toward increased profit through better adjustment of his resources and more economical effort should consider the problems on his individual farm in the light of probable prices, yield or production and requirements and adaptability of different enterprises to his farm. The manager will do well to direct his effort to producing those things for which he and his farm are best suited. Not all farms are equally adapted to corn or cotton, and the crop which is best adapted to the particular farm will ordinarily be most profitable, assuming that a market is available.

A farm with an abundance of land on which corn and hay can be readily grown will produce dairy and pork products more profitably than a farm with higher thinner land on which cotton can be produced more economically than other crops. Some light soils may return more profit from such crops as sweet potatoes, or peanuts than from ordinary field crops. Other farmers will find

that a local market will make sorghum or cane, and syrup making one of their most profitable enterprises. A farm near a market for whole milk will probably keep more cows and produce less of some other product than an equally good farm which has no market for milk available.

Bulletins 228, 237 and 243 show that production costs vary widely on farms in a given locality. Enterprises which were profitable on some farms were unprofitable on others, and in selecting his enterprises the farmer should consider the relative profitableness on his own farm. Table 29 shows the yields of cotton, corn, oats and lespedeza, which would give equal returns per acre at a given price and a given production cost. The cost of production is the average for the farms on which detailed records were kept in 1924, 1925 and 1926.

TABLE 29—YIELDS PER ACRE OF CORN, OATS AND LESPEDEZA HAY AT GIVEN PRICES EQUAL IN NET VALUE PER ACRE TO DIFFERENT YIELDS OF COTTON LINT AT 20c PER POUND

Crop	Prices Per Unit	Unit	YIELDS OF EQUAL NET VALUE PER ACRE						
Cotton	$ .20	Pound	100	125	150	175	200	225	250
Corn	1.00	Bushel	9.8	14.8	19.8	24.8	29.8	34.8	39.8
Oats	.65	Bushel	5.2	12.9	20.6	28.3	36.0	43.7	51.4
Lespedeza	20.00	Ton	.12	.37	.62	.87	1.12	1.37	1.87

Note: Land use cost was not considered in the costs used in making the above comparisons.

If the cost of production on a particular farm was equal to the average cost for the area and prices were those given in the table a farmer would find cotton more profitable than corn on a field which would produce 150 pounds of lint cotton unless 20 bushels or more of corn could be produced. Or cotton on the same field would be slightly more profitable than 20 bushels of oats or .6 tons of hay.

This table illustrates the importance of producing the crop best adapted to a particular farm or field. But considerations other than immeditae cash return should enter into the choice of enterprises and the system of farming should be planned to return most profits over a long period of time.

Relative prices for products will also determine in a measure the most profitable system or the most profitable crop. When cotton is high in price the farm with a large proportion of cotton benefits more than one with a small acreage and conversely suffers more when the price of cotton is low. A change may be made, however, in adjusting acreage to prevailing prices and growing more cotton when cotton is likely to be high in price, and more of other crops when the price of cotton is expected to decline.

Violent changes in organization are costly when such shifts involve increased equipment or the disuse of equipment on hand. Changes can not be made readily from dairying to cotton or from cotton to hogs or sheep. Some shifts can be made, however, in a more limited way, and an organization which is based on normal yields and prices should prove most profitable in the long run. Adjustments to prices can best be made by curtailing production on the least profitable enterprises in times of unfavorable prices and expanding production on those enterprises for which it is thought that the market will be favorable.

An illustration of this would be changes made in the dairy and cotton

farm last described. If conditions were such that a price of 30c per pound could be expected in the fall, the acreage of corn, or pasture, could be reduced and the acreage of cotton increased as much. The reduction in feed crops would necessitate cutting down dairy production by eliminating a few of the least productive cows. With cotton prices very low and dairy products relatively high some of the land least desirable for cotton could be put in feed crops and cows which would normally be turned off could profitably be kept on for a longer period.

Each farm is an individual unit, and the most profitable combination of enterprises will differ on dissimilar farms. It is by knowing the possibilities of production of each of his fields, and knowng the approximate amount of elements of cost which must be applied to each to obtain a given production that an operator can choose his cropping system to obtain the highest profit from his land. To obtain the best use of his labor, crops and livestock enterprises which distribute his productive labor throughout the year are necessary. The choice of livestock enterprises rests in part on the quality and nature of feed available, ready markets and prospective prices.

Planning the Individual Farm

Forms which will enable the farm operator to more easily plan his business are provided on pages 47 to 50. Knowing the productivity of his fields and livestock, and probable returns from them, the plan for the operation of the farm may be formulated and probable results from different methods determined. These forms are the same as those used for tables 19, 20, 21, 22 and 23, and these tables may be used to illustrate just how the farm data are to be filled in.

Where the suggested requirements used in the bulletin do not apply to the particular farm, other figures may be used. The references cited will be of assistance to the operator in arriving at usual requirements for his farm. Other bulletins or books relating to crops and livestock may be used, or the county agent may aid in getting data applicable to particular conditions. For instance, a farmer who has cows capable of producing 250 pounds of butter fat per year will allow more feed than that included in the requirements given here, or if a field will produce a good yield of corn without fertilizer it may not be advisable to use fertilizer and the elements of cost will be reduced.

A farm map will help in keeping acreages of each field, previous crops and condition of the fields in mind.

If man labor and horse work are to be hired it may be advisable to enter the amount in the column headed "labor" of form "A." These same columns may be used to compare total labor on different crops.

A form such as table 30 may be used as a guide for estimating feed requirements for livestock. The figures given in this table show the amount of feed per head used in estimating feed requirements on the suggested systems. These quantities will differ somewhat on individual farms and a certain amount of substitution may be made. The amount and quality of the available pasture will affect the amount of feed given.

The problem of estimating a probable price is difficult. However, bulletins and reports showing the prices that have prevailed in past years, trade publications, reports on market conditions, such as outlook reports from the

Experiment Station, Extension Service and Department of Agriculture, will give the producer a basis for arriving at expected prices.

Alternative systems of farming may be worked through on forms similar to those which follow, and the results from the different systems compared. It is careful planning that eliminates waste in production and permits farmers to make the best of existing conditions.

TABLE 30—EXPECTED FEED REQUIREMENTS PER YEAR PER UNIT OF LIVESTOCK

FEED—	Horses, 850 lbs.	Cows (1)	Heifers	Calves	100 lb. gain Feeder Pigs (2)	Per Sow (1)	100 Head Poultry (1)	Ewes	Lambs
Shelled Corn, lbs.	1,820				350	1,000	1,000		
Gr. Corn, lbs.		600	200	200			1,000		40
Oats, lbs.	780					200	1,000		
Gr. Oats, lbs.		300	150	150			1,000		10
C. S. Meal, lbs.		300	150	150				60	
Hay, lbs.	2,860	3,000	2,000	500				120	
Straw, lbs.									
Bran, lbs.							1,000		10
Tankage, lbs.					25	100			
Milk, lbs.				350					
Skim Milk, lbs.				3,000			9,000		
Production		200 lbs. B. F.				7 pigs	750 doz. eggs 250 lbs. poultry		

(1) With production as shown.
(2) Allowance for dry lot feeding.

Forms similar to A, B, C, D, and E are described, and a method of using them outlined in more detail in Farmers Bulletin 1564 of the U. S. Department of Agriculture.

FORM "A"—FOR ESTIMATING CROP PRODUCTION (See Table 19)

Crops	Acres Number	Yield Per Acre Amount	Total Production Amount	Fertilizer Used Tons (a)	Man Labor Hours (b)	Horse Work Hours	USE OF CROP			Value of Sales Dollars (c)
							Feed Amt.	Seed Amount	Sales Amount	

(a) Cost of fertilizer to be calculated and carried to Form "D"
(b) Cost of hired labor goes to Form "D"
(c) Total of sales goes to Form "E"

FORM "B"—FOR PROPORTIONING FEED FOR LIVESTOCK

(See Table 20)

In this Column List the Kind of Livestock	No. of Head	IN THESE COLUMNS LIST THE AMOUNT OF FEED FOR EACH KIND OF LIVESTOCK										
		Corn Bu.	Oats Bu.	Bran Lbs.	C.S. Meal Lbs.	Shorts Lbs.	Corn Chops Lbs.	Tankage Lbs.	Hay Tons	Straw Tons	Hulls Tons	Silage Tons
Mules												
Young Stock												
Cows												
Young Cattle												
Bulls												
Sheep												
Sows												
Pigs												
Chickens												
Totals Amts.												
Total Value												

Difference between totals here and items on Form "A" must be bought.
Carry value of purchased feed to Form "D"

FORM "C"—FOR ASSEMBLYING PRODUCTION AND ESTIMATING INCOME FOR LIVESTOCK—(See Table 21)

KIND—	List Number Kept	List Expected Production Per Head	List Total Production	List Amt. or Number Used Here			Expected Price	Value of Sales	Value used in Home
				Used in Home	Amount Fed	Amount For Sale			
Cows									
Young Cattle									
Hogs									
Poultry									
Sheep									

Carry total sales and value of products used in home to Form "E"

FORM "D"—FOR ASSEMBLYING EXPENSES—(See Table 22)

CROP EXPENSES—	Units	Cost Per Unit	Total Value
Ferilizer—Cotton			
Corn			
Oats			
Other			
Seed—Cotton			
Corn			
Oats			
Grass			
Soy Bean			
S. Potatoes			
Other Crops			
Threshing			
Ginning			
Purchased Feed			
Miscellaneous Expenses—			
Breeding Fees			
Blacksmith			
Repairs			
Machinery			
Buildings			
Labor			
Insurance			
Taxes			
TOTAL			

FORM "E"—FOR ESTIMATED FINANCIAL STATEMENT

Cash Receipts From:

Crops—From Form "A" .....

Livestock—From Form "C" .....

Livestock—Pro.—From Form "C" .....

Miscellaneous, for labor off the farm, sales of wood, ties, etc. .....

Total .....

Less Cash Expenses—From Form "D" .....

Net Cash Return .....

Add value of products used in home—From Form "C" .....

Total net returns from proposed plan .....

BULLETIN No. 258 SEPTEMBER, 1928

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
Agricultural College, Mississippi
J. R. RICKS, Director

DEGENERATION DISEASES OF THE IRISH POTATO IN MISSISSIPPI

By
H. H. WEDGWORTH, *Associate Plant Pathologist*
State Plant Board

Comparison of yields of potatoes in 1927. A, Spindle-tuber; B, leaf-roll; C, rugose mosaic; D, mild mosaic; E, healthy.

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. COLLEGE, MISSISSIPPI
J. R. RICKS, Director

Degeneration Diseases of the Irish Potato in Mississippi

By

H. H. WEDGWORTH, *Associate Plant Pathologist, State Plant Board*

The degeneration diseases constitute one of the most important groups of infectious diseases affecting the Irish potato in Mississippi. These diseases occur in practically all of the Irish potato growing sections of the United States as well as in many foreign countries. The most important diseases of this group in Mississippi are commonly known as mosaic, leaf-roll, and spindle-tuber. The exact origin of these diseases is not known. They have undoubtedly been present in this country for many years and have probably been the chief cause of the "running out" of potatoes, a condition which has generally been attributed to various causes, such as climate, soil, continuous production by seed cuttings, etc.

DESCRIPTION OF DISEASES

Mosaic. There are apparently several types of mosaic affecting the Irish potato. Two of these types are very common

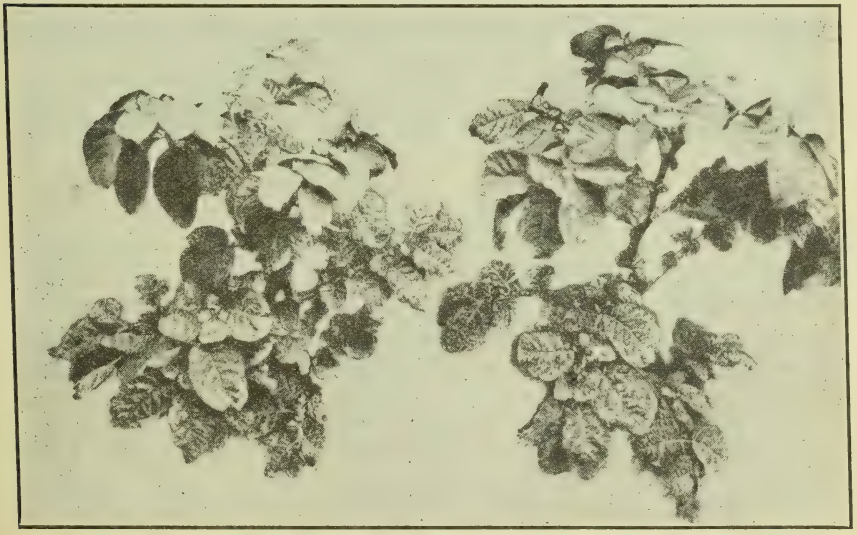


Fig. 1. Plants infected with mosaic showing the typical crinkling or puckering of the lower leaves.

in Mississippi, namely mild mosaic and rugose mosaic. The leaves of plants which are affected with mild mosaic are mottled with yellowish-green or light green spots which usually shade off gradually into the adjacent normal, green tissues. These spots vary greatly in size, shape, location, and abundance. They are seldom more than one-fourth of an inch across although they may follow a vein in the leaf for a much longer distance. They may be circular in outline but are usually more irregular and more or less elongated. At high temperatures, these symptoms tend to disappear and it is then difficult or impossible to dis-

Fig. 2. A, Healthy plant; B, plant infected with rugose mosaic.

tinguish diseased from healthy plants. A period of from four to six days of high temperature is sufficient to mask the symptoms of this type of mosaic. This does not mean however, that plants upon which the symptoms tend to disappear have recovered from the disease because they produce infected tubers and may serve as a source of infection for healthy plants. This type of mosaic does not ruffle or pucker the leaves as badly as the rugose type nor does it dwarf the plants and reduce the yield rate as much.

The rugose type of mosaic is the one most commonly recognized because it causes the leaves to become crinkled or puckered between the veins (Fig. 1), dwarfs the plants (Fig. 2), and greatly

reduces the yield rate. This type of mosaic also causes a mottling of the leaves but this symptom is not nearly as distinct as in the case of mild mosaic. The leaves of infected plants have a tendency to be curled downward and the plants have a sickly yellow color. The tubers produced on plants infected with both types of mosaic appear normal except for size, making tuber selection impossible.

Leaf-roll. Plants infected with this disease are usually badly dwarfed and show a very severe upward rolling of the leaflets (Fig. 3). The leaves are stiffer and thicker to the touch than normal ones which give the plants a very rigid appearance. They

Fig. 3. Potato plant infected with leaf-roll.

may become yellowish, reddish, or purplish in color and finally small, dead areas may be produced near the tips. The symptoms of leaf-roll on plants which are produced from diseased tubers are more pronounced on the lower leaves while in the case of plants which become infected during the growing season, the rolling is first noticeable on the upper leaves.

On the underground part of the plants, the stolons on which the potatoes are produced are greatly shortened, resulting in the potatoes being produced very close to the tap roots. Aside from this character, there are no other constant symptoms on the underground parts. In many cases, however, the tubers have a net-like darkening of the tissues which may be seen as spots or

streaks when the tuber is cut in sections. Infected tubers show a marked crispness and often produce very weak, spindling sprouts. This disease reduces the size and number of tubers very much, but does not affect the shape.

The rolling of potato leaves due to wilt diseases, Rhizoctonia, black-leg, excessive moisture in the soil, etc., should not be confused with leaf-roll. The rigidity or stiffness of plants infected with leaf-roll distinguishes them from plants with limp, wilted leaves which are characteristic of wilt diseases, black-leg, and the

Fig. 4. Potato plant infected with spindle-tuber. (After Goss)

early stages of tip-burn. In the case of Rhizoctonia, the leaves are usually smaller, the nodes of the plants are rather enlarged, and there is the characteristic browning of the underground part of the plants. The rolling of the leaves due to excessive moisture is usually confined to areas in the field where the soil is too wet.

Spindle-tuber. Plants infected with spindle-tuber usually have fewer stalks per hill which are dwarfed, somewhat spindling, and very erect (Fig. 4). In the early part of the season, the leaves

are smaller, somewhat darker green in color, have slightly ruffled edges, and tend to point upward. Later in the season, the leaves become more dwarfed, are usually not distinctly ruffled, and show a slight rolling along the margins.

The effect of spindle-tuber on the vines is not nearly as conspicuous as that produced by mosaic and leaf-roll. It differs from these diseases in that it affects the tubers as well as the tops. In severe cases, the disease causes the tubers to become long, cylindrical, and spindling with tapering ends (Fig. 5). In the Triumph variety, the color of diseased tubers is much paler than that of normal tubers and they appear somewhat blotchy. The eyes are more numerous, shallower, and sometimes bulged out and the skin is usually smoother and tenderer, making the tubers more easily

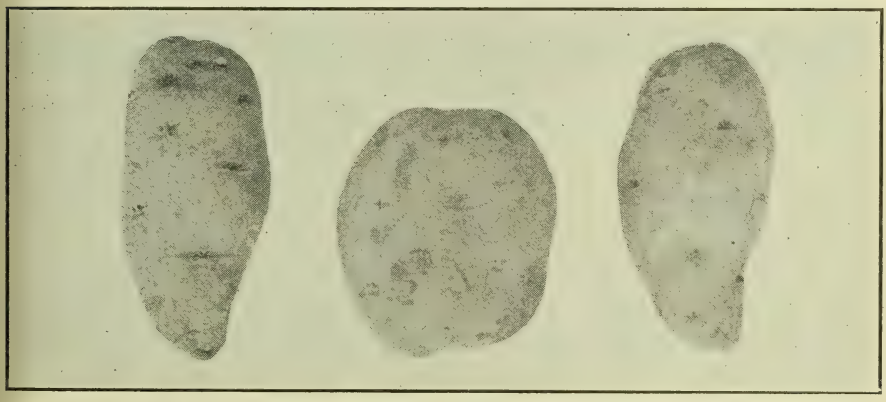


Fig. 5. Potato tubers showing the spindling effect of spindle-tuber as compared with a healthy tuber (center).

bruised or cut. When infection takes place late in the season, there may be no noticeable effect on the vines or tubers. The tubers from such plants are infected, however, and when used for seed produce diseased plants.

Causes of Degeneration Diseases

Although the causes of mosaic, leaf-roll, and spindle-tuber are unknown, many points regarding the nature and methods of transmission of these diseases have been determined and are practically the same in each case. It has been found that the juices from diseased plants contain the infectious principles known as viruses which cause these diseases; that is, the juice taken from a diseased plant and introduced into a healthy one will cause it to become infected with one of the diseases in question.

The healthy plants will usually show evidence of disease in from two to four weeks after they have become infected. Aphids or plant lice are responsible for the greater part of the spread of these diseases in the field in that they carry the juices from diseased plants to healthy ones. The fact that plant lice are so numerous on the potato in the South probably accounts for the consensus of opinion that potatoes "run out" very quickly in this section of the country. As has been pointed out previously, the diseases are carried from one season to the other in the tubers. They may also be carried from one season to the other in plants which are closely related to the potato. It is probable that these diseases can be transmitted from one tuber to another by the knife used in cutting the seed pieces, but this has been demonstrated only in the case of spindle-tuber. This method of transmitting the disease is relatively unimportant if abnormally-shaped tubers are discarded before cutting and the cutting knife is kept clean.

Effect of Some Degeneration Diseases on the Yield of Irish Potatoes

The effect of these diseases on the yields of Irish potatoes was carefully studied during 1927 and 1928. Irish potato seed of the Green Mountain variety, which were infected with mild mosaic, rugose mosaic, leaf-roll, and spindle-tuber, were courteously furnished each season by Dr. E. S. Schultz of the United States Department of Agriculture for this work. The experiments were conducted on well drained, sandy loam soils which were quite uniform in texture. All lots of seed received the same fertilization, cultural care, etc. The results from these experiments are given in table 1.

Results Showing the Effect of Degeneration Diseases on the Yields of Irish Potatoes During 1927 and 1928

Disease	1927*		1928**	
	Bushels per acre	Per cent of check	Bushels per acre	Per cent of check
Healthy (check)	89.2	100.0	180.2	100.0
Mild mosaic	63.6	71.3	131.2	72.8
Rugose mosaic	27.0	30.3	71.3	39.6
Spindle-tuber	40.4	45.3	79.2	44.0
Leaf-roll	18.7	21.0	68.9	38.2

*Average of 2 plats. **Average of 4 plats.

The results obtained during the two seasons were very similar. In 1928, the symptoms of leaf-roll and rugose mosaic were not nearly as pronounced as in 1927 which may account for some of the variation in the yields during the two seasons. These results indicate that leaf-roll reduces the yield to a greater extent than any one of the other diseases under Mississippi conditions. Due to the fact, however, that mosaic is more prevalent in the State, it causes by far the greatest total loss of this crop. These figures indicate that the degeneration diseases are probably more severe under Mississippi conditions that under those of some of the western and northern states.

Control of Degeneration Diseases

Due to the fact that the infectious principles causing these diseases are in the inside of the potato plants and tubers, it is obvious that spraying the plants, treating the seed, or any other surface treatment would be worthless. Since tubers infected with mosaic, leaf-roll, and mild forms of spindle-tuber cannot be detected, the question of tuber selection is impossible. The same is true for hill selection after the tops of the plants have died down. Since plants infected with the degeneration diseases can be detected in the field, it is possible to eliminate or reduce these diseases to a great extent. If potatoes are being grown for seed purposes, it is necessary to go through the field or seed plats and dig out all diseased plants and tubers at frequent intervals starting in the early part of the season and continuing until harvest. To aid in detecting diseased plants, the potatoes should be planted in tuber units; that is, all of the seed pieces from a given tuber should be planted in adjacent hills of the same row. By having the seed pieces from a given potato together which may prove to be diseased, the affected plants will be much easier to detect and eliminate; whereas, by planting the seed pieces at random, some of the diseased plants may be overlooked.

Under Mississippi conditions where the population of aphids in potato fields is very great, it is necessary to have a seed plat of potatoes well isolated from all other potato fields. It is also necessary to start the seed plat with disease-free seed stock and to rogue out all off-type plants including diseased ones at frequent intervals. Some of the difficulties of producing seed potatoes in Mississippi on a commercial scale are:

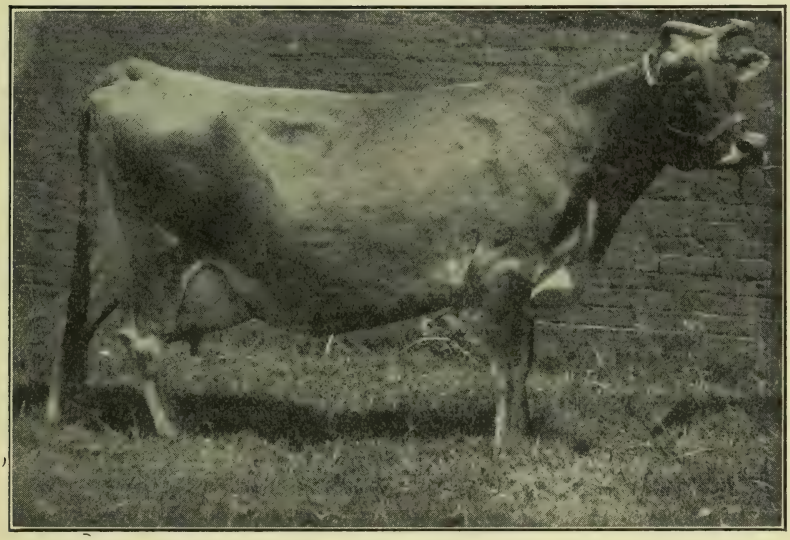
1. With the large number of aphids in this section, the degeneration diseases are spread so very rapidly.

Bulletin No. 259 January, 1928

FEED, CARE *and* MANAGEMENT OF THE DAIRY COW

By

J. S. MOORE



EM. OSIE L.

The type of Jersey cow that will make dairying profitable in Mississippi.

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. COLLEGE, MISSISSIPPI
J. R. RICKS, DIRECTOR

FEED, CARE, AND MANAGEMENT OF THE DAIRY COW

Importance of Dairy Farming in Mississippi.—The system of farming that has been in general practice in this State—the growing of cotton as the main money crop—has resulted in impoverished soils, low crop yields, small net incomes, lack of profitable use of labor on the farm, and an unsatisfactory credit system. No permanent, profitable, and stable system of farming can be maintained, based upon a one-crop plan. The history of dairying in other sections of the country has been such as to lend encouragement to those who would turn to dairying as a means of overcoming the above difficulties. To secure the benefits to be derived from this industry, however, we must recognize that greater skill and training are needed than are required by the farmers who grow only grain or cotton. Cotton probably should never be replaced on the average farm by dairy cows, but the most profitable returns will, no doubt, be on those farms where the cotton is supplanted by the dairy cow. Such a combination will add one or more sources of income and will make possible a rotation of crops which will aid materially in maintaining the fertility of the soil and increasing its productiveness. It is true that the mere fact that a farmer has dairy cows on his farm does not necessarily mean that the fertility of his soil will be built up or even maintained. The real dairyman, however, realizes the importance of growing feed for his cows. This leads to diversification and the planting of legumes. Crop rotation will be practiced. In most cases he will find it to his advantage to buy some concentrates, which will, as a rule, be rich in plant food. By the judicious purchase and use of these feeds and careful conservation of the barnyard manure which will be applied to those lands and crops from which the greatest returns may be expected, he can and does add to the fertility of his soil each year. The dairy cow consumes a large amount of roughage and converts these roughages into one of the best of all human foods—milk. She not only has the ability to do this, but she is the most economical producer of human food of all our domestic animals.

A careful study of this industry indicates that it is a safe business as compared with the growing of cotton. The yield and the price are much more stable in the case of dairy products. With the addition of this industry to our farming operations, we are able to utilize the labor on the farm profitably for a much longer period each year than is possible where cotton alone constitutes the money crop.

DAIRY BREEDS

It is not the purpose of this bulletin to discuss the merits of the various breeds but simply to call attention to each, with some of their characteristics.

Jersey.—This breed was developed on Jersey Island and has been bred pure for centuries. It is one of the smallest of the dairy breeds—the cows weighing from 800 to 1,000 pounds. The animals may be of any color or combination of colors, from light fawn to almost black. White spots are

not an indication of lack of purity in breeding. The Jersey excels in conformation or dairy type. She is a good grazer, and the purebreds are strong in being able to transmit their qualities to their offspring. In the economical production of butter fat, she, with the Guernsey, is probably unexcelled.

Guernsey.—This breed originated in Guernsey Island. They are somewhat larger and coarser than the Jersey. The conditions favorable for the latter will usually be found satisfactory for this breed. Next to the Jersey, they give the richest milk of all the dairy breeds, which is of an exceptionally deep yellow color.

Holstein-Friesian.—This is the largest of all the dairy breeds. The cows weigh from 1,000 to 1,500 pounds. The native home of this breed is Holland. It is probably the oldest of all the dairy breeds. Holstein-Friesians are black and white in color—the two colors never blending. The cows of this breed are noted for their large milk production, excelling all others in the amount produced and, while the milk is not rich in butterfat, the amount is sufficient to enable the animals of this breed to hold a very large per cent of the official records of one thousand pounds of fat or over in one year. Good pastures and heavy feeding are essential for success with this breed.

Ayrshire.—This is a comparatively young breed that has been developed in Ayrshire, Scotland. The animals of this breed resemble the Guernseys in size, but are more like the Holstein-Friesian in conformation or type. They are red and white in color. The cows are active and make excellent grazers. They give less milk than do the Holstein-Friesian, but it is somewhat richer in butterfat. The calves are of good size at birth, weighing from 80 to 90 pounds, while the Jersey calves average from 50 to 55 pounds at birth. The calves fatten readily and make good veal.

From the above description, it will be noted that the conditions under which the animals are to be kept and the purposes for which they are to be used, should, to some extent at least, influence us in determining the breed that we select. It should be recognized, however, that there are good producers in all of the above and that the breed is not as important as the selection of the individual within the breed. As a rule, we should select that breed that is being used most largely in the community, or at least the one that is proving most profitable.

SELECTION OF THE INDIVIDUAL COW

One of the weakest points in our dairy system is the failure on the part of a large number to appreciate the importance of individual selection. We give below a summary of the ten high producing and the ten low producing cows in the College herd, together with the average for the entire herd, and also the average for the dairy cows in Mississippi

Table 1. Results of Twelve Months' Record of College Herd and of Average Cows for the State.

Items	COLLEGE HERD			Avg. Yield of Cows in the State (Estimated)
	Avg. 10 Best Cows	Avg. 10 Poorest Cows	Avg. for the Herd	
Milk produced, lbs.	9060	4204	7000.1	2000
Butterfat produced, lbs.	450.5	192.6	317.7	100.
Value of fat @ 40c	$180.20	77.04	127.08	40.00
Value of skimmilk @ 20c per 100 lbs.	14.49	6.73	11.20	3.20
Total value of products	194.69	83.77	138.28	43.20
Cost of grain feed per cow	71.62	31.24	51.22	25.00
Cost of roughage per cow	18.48	18.46	21.32	15.00
Total cost of feed	90.10	49.70	72.54	40.00
Profit over cost of feed	$104.58	34.07	65.74	3.20

A careful study of this table shows that the ten poorest cows ate as much roughage as did the ten best and that the herd as a whole ate more roughage per cow, the difference in cost of feed being in the amount of grain required. It is clear that the average cow in the State with her low yield scarcely pays for the feed she consumes to say nothing of all the other expenses incurred. The average cow in the College herd paid $65.74 above cost of feed, and the average for the best cows was nearly double this, or $104.58.

Methods of Selection.—In the selection of the individual cow, the following points should be considered; namely: (1) production (2) type (3) purity of breeding (4) health. The large producer is, as a rule, the most economical animal. If records are available, this would be a much safer guide in selecting the individual than the second, which is selection by type or conformation; but since only a very small per cent of the cows have available records and those with large production are either not for sale or, if so, are held by their owner at such a price as to prevent most people from buying, the latter method must be used. Where type is to be employed as the method of selection, the purchaser should be familiar with the points that indicate good dairy type. He should at least recognize the following as indicative of a good producer: (a) the cow should be angular in form and when in full flow of milk should carry no surplus flesh. A good physical condition with soft, pliable, oily skin, covered with fine smooth hair will indicate that the lack of flesh is not due to insufficient feed; (b) the udder should be large, free from fleshiness, and should be attached well up behind and extending far forward in front with good width throughout; the milk veins should be large; (c) the heart girth should be large and the barrel should be long, wide, and deep, especially just in front of the udder. The cow must have capacity of barrel to be able to handle large amounts of food. While it is possible for a competent judge to distinguish between good and inferior cows on type alone, he, oftentimes cannot distinguish between the cow capable of giving three

hundred pounds of fat and the one giving four hundred pounds of fat. In addition to selecting a cow that is a large producer and one of good type, the purchaser should see that she has every indication of good health; that she is free of tuberculosis and contagious abortion and that she comes from a herd free of these diseases. If a grade cow, the higher the percentage of purebred blood of one breed she carries, the more likely she will be to transmit her quality to her offspring.

Importance of Records.—Experience has shown that the average dairyman who keeps no records is not able to pick out the good from the poor cows in his herd. Certainly, then, there is no excuse for those who have herds started for not keeping such records as will enable them to know the profitable cows. Such a record will include the amount of milk produced and the butterfat it contains, together with amount of feed consumed. The advantages of these records may be summarized as follows: (1) They enable the dairyman to know definitely which are his profitable cows and he is in position to dispose of the inferior animals. (2) Where daily milk records are kept, the cows may be fed more intelligently. The milker is more likely to detect any sickness in its early stages in an individual animal, and such a record may be used as a check on the milker himself. (3) More interest is taken in the work and this leads to greater profits.

Results in the past indicate that the most satisfactory method of getting such records as are needed is through the formation of Herd Improvement Associations. This is simply an association of twenty to twenty-five dairy farmers getting together for the purpose of employing a tester who makes all the necessary records on each herd and who furnishes to the owner the information he needs to know concerning each of his cows.

SELECTION, CARE, AND MANAGEMENT OF THE HERD SIRE.

Importance of Selecting the Sire.—If we accept the statement as true, that approximately one-half of the cows in the State are kept at a loss because of their low production, the need for increase in the yield is apparent. It is true that many cows have a much higher capacity than their records would indicate due to the method of handling and feeding, but while this is true, it is also an established fact that no system of feeding will enable the owner to make a cow give 5,000 pounds or more of milk if her capacity is limited to 3,000 pounds per year. In this latter case, the only plan by which improvement may be secured is by the use of sires capable of transmitting to their offspring greater producing qualities than are possessed by their dams. The selection of a suitable sire, therefore, becomes a very important step in the process of building up a herd and has led to the expression that "the sire is half the herd." Our own herd furnishes the following illustration showing the value of a good sire in increased production. There are 14 daughters of Pogis 99th of Hood Farm 28th in the College herd that have completed one or more lactation periods. Correcting all records by changing to the equivalent of a mature cow and comparing the best record of the daughters with the best records

of their dams, we find the average yield of the daughters is 10,962 pounds of milk containing 592.5 pounds of fat, while that of the dams is 8,190 pounds of milk containing 395.8 pounds of fat. All daughters have better records than their dams. The average increase over dams in 2,772 pounds of milk and 196.7 pounds of fat. This is an increase in per cent of fat of 47.9.

One of the most striking illustrations of the value of good sires is shown by the experiment conducted by the Iowa Experiment Station. In this experiment thirteen common cows were purchased and bred to good purebred dairy sires. Complete records were kept of the original cows and their offspring. The original cows, with a total of 74 lactation periods, averaged 3,847 pounds of milk and 182 pounds of fat. Thirteen daughters of these cows with 40 lactation periods averaged 5,556 pounds of milk and 253 pounds of fat. Five granddaughters with six lactation periods averaged 8,311 pounds of milk and 376 pounds of fat. An increase over the original scrubs of 116% in milk yield and 106% in fat produced.

In the selection of a herd sire, we should consider something more than the purchase of a purebred animal. If possible, a proven sire, if healthy, a safe breeder, and if he has no objectionable traits, is to be desired. Such animals are difficult to find and often are valued at prices in excess of the amount that most dairymen are willing to pay. In any case, the sire selected should be of good breeding. His dam should be of good type and a large producer. His sire should show ability to transmit type and production to his daughters. Not only should the immediate parents show these qualities, but these characteristics should be possessed by the ancestors for several generations as it is only from such animals that we may reasonably expect the sire selected to transmit the desirable quality to his offspring. In addition, he should be of good type, from a healthy herd and of good size for his age and breeding.

Care of the Sire.—The calf should be fed liberally in order that it may have sufficient size. Bull calves should be separated from the heifer calves when about six months of age. A bull that has been well fed may be used for light service when ten to twelve months old, but he should be bred to only a few cows before he is eighteen months of age. When two years old, during the heavy breeding season, the bull may serve from four to five cows a week. In this case, however, he should not be bred to more than one cow a day except in rare cases when two cows may be allowed. A dairy bull should not be allowed to run with the herd. He should be kept in a well fenced enclosure and given plenty of exercise. A liberal supply of legume hay—ten to twenty pounds should be fed and in addition, four to ten pounds of a good grain mixture should be given, depending on the size, condition, and amount of work required. The following is satisfactory grain mixture for this purpose:

100 pounds cottonseed meal, 200 pounds ground oats, 200 pounds wheat bran, and 300 pounds ground corn.

Importance of Calf Raising.—The average productive period of a dairy cow is about six years. Assuming that one-half of the calves are females, that all the cows calved each year, and that none of the heifer calves were lost, it would require one-third of this number to replace the cows or to keep the herd number constant. Most farmers begin with ordinary cows, and, as a rule, this is the best plan. The development of a high class herd from these will depend largely upon (1) the careful selection of individual cows (2) the use of a good sire, and (3) the proper raising of the heifer calves from the best cows.

Raising Calves by Hand on Skimmilk.—The first milk of the cow after calving is known as colostrum. The calf needs this colostrum to properly start the digestive process. We leave the calf with its dam for twenty-four hours after birth. At this time, if the cow's udder is in good condition, the calf is taken from its mother and fed on milk produced by her for a period of about three weeks. The Jersey calf is given two feeds a day of from four to five pounds of milk at a feed, depending on the size of the calf. Calves from some of the other breeds, being larger at birth, are fed somewhat more. When the calf is three weeks old, we gradually change to skimmilk, reducing the amount of whole milk and substituting therefor a like amount of skimmilk, taking about ten days to make the complete change. As the calf grows older, the amount of skimmilk may be increased until it is getting 16 to 18 pounds daily. Over-feeding, however, should be avoided. We should remember that the natural food of the young calf is the milk provided by its mother and that such milk is warm (about 100 degrees F.), that it is sweet, and that it is clean. In order to raise calves successfully on skimmilk, these conditions should be met. The skimmilk should be fed warm, it should be sweet, and every precaution should be taken to see that all vessels are kept clean. The failure to observe these simple but necessary rules has often been the cause of failure to raise good healthy calves.

Feeding Hay and Grain.—When the calf is from three to four weeks old, it should be fed hay and grain. As a grain feed, we have found a mixture of equal parts by weight of corn chops and crushed oats to be satisfactory. Feed all the calf will eat until it is eating two pounds per day. This will be as much as it should receive at any time before it is six months of age. No more should be given than will be eaten up clean twice each day. If grain is allowed to remain in the trough it often becomes damp and ferments, and may, like dirty pails and sour milk, cause scours. The feeding of hay should begin about the same time we start feeding grain. Only well cured legume hay should be used. The calf can be fed all the hay it will eat. When it is six months old the feeding of skimmilk may be discontinued, but it should still receive all of the legume hay it will eat, and from two to three pounds of grain feed daily. Some feeders object to using legume hay when the calf is under three months of age, claiming that it is so laxative that it causes scours. We have had but little trouble from this cause; but if grass hay is used, it should be of

good quality. If the calves between the ages of six and twelve months are on good pasture, two pounds of grain daily should supplement the pasture. If pasture is not available, give all the legume hay in addition to the grain the calf will eat. At the age of from one to two years the calf will do fairly well on pasture alone, provided the pasture is good. For a winter ration at this age give from two to three pounds of grain and all the legume hay it wants.

If the heifer is well developed, she should be bred at from fifteen to eighteen months of age. If bred too early, she will fail to get sufficient size before calving. The cost of raising heifers is such that it will not, as a rule, be found profitable to keep any but the best heifer calves from the highest producing cows and those sired by a well bred bull.

HERD MANAGEMENT

Regularity and Kindness.—It is now recognized that the large yields of milk and butterfat produced by the leading animals of the dairy breeds are due in no small degree to the care and management given them by their owners. A good dairyman must love his cattle and there must be that relation between them that is often seen between the master and his favorite dog. A cow is a creature of habit and when she becomes accustomed to a regular routine regarding feeding and milking, a change from this has a tendency to disturb her and to decrease her yield. The Jersey, especially, has a highly developed nervous system and anything out of the ordinary is likely to have a harmful effect.

Fall vs. Spring Calving.—Much has been said in regard to the best season of the year for the cow to calve. It is unusually pointed out that fall calving is more profitable for one or more of the following reasons: (1) a cow calving in the fall will give more milk and butterfat during the entire year than she would by freshening in the spring, (2) the yield will be much greater during those months—the winter period—when the price of dairy products is usually highest, (3) as a rule, on the farm, labor is more plentiful during the winter months and more attention can be given the cows, (4) both the cow and the calf can be kept more comfortable in winter than in summer due to the absence of flies and the intense hot weather. Where the cow receives the proper treatment and feed the above arguments are sound. In too many cases, however, in the South the cows are not protected from the cold and rain during the winter months. They are often given little more than a maintenance ration. With such lack of care and feed, the cows are likely to be practically dry before spring pastures are available and the yield will be less than where they calve in the spring.

In order to see the results in the College Herd, we have determined the average yield of cows calving in the fall and the spring for the first eight weeks after calving and for the last eight weeks seven months after calving for two years. Forty-nine cows calved in the fall of the year and at the end of seven months they were giving on an average 18.0%

less milk than at the time they were fresh. Thirty-five cows calved in the spring and they were giving at the end of seven months 42.6% less milk than when fresh.

Dehorning.—We know of no useful service that can be performed by the horns on the dairy cow. On the other hand, we have seen a number of animals injured by their use. Dehorned cattle may be housed in a much smaller space than is possible where they have horns. Bulls are safer to handle where the horns have been removed. The best time for dehorning the animal is before it is seven days old and the best method is by the use of caustic potash. Clip the hair covering the button. Moisten one end of the stick of caustic potash and rub on the spot over the button until the skin becomes inflamed. Care should be taken not to put sufficient water on the caustic to allow it to run down the side of the calf's head. A paper should be wrapped around the end held in the hand to prevent blistering. If sufficient caustic is used, a dent will be left in the skull after a few days, showing that the horn has been destroyed. For older animals the saw or clipper may be used. This should be done in early spring or late fall and care should be taken to cut the horns close to the head. The rule is to cut a ring of skin about one-fourth inch wide with the horns. If weather is warm, precaution should be taken to keep flies out of the wound.

Drying Off the Cow.—Our practice is to give the cow a rest from milking for at least six weeks. We have found that by so doing, she will start her next lactation period in better physical condition and that, as a rule, she will produce more than when she does not get this rest. Some cows have been bred for high production for so long that it is necessary to force them dry. In such cases about two months before the cow is due to calve, discontinue grain feed and, if on good pasture, it may be necessary to keep in a dry lot. Milk the cow only once a day for a few days. Gradually increase the intervals between milking until no further milking is necessary or until the amount has been reduced to four or five pounds per day. As soon as the cow is dry, she should be fed so as to put her in good condition for her next lactation period. If thin in flesh she should be given four to five pounds of grain feed daily in addition to all the roughage—preferably good pasture or legume hay—she will eat. If the cow is carrying considerable flesh at the time she stops milking, the amount of grain need not be so large. It should be remembered, however, that the cow should carry some surplus flesh at the time of calving. This will be converted into milk during the first thirty to sixty days after freshening. About one week before she is due to calve, cut down the grain feed to two or three pounds per day, giving a mixture of such feeds as wheat bran and oats. Care should be taken to keep the cow as comfortable as possible at the time and if the weather is not such as to permit calving in pasture, a clean, well bedded stall should be provided. After calving, feed lightly for several days on wheat bran and other laxative feeds with good roughage.

Large producers are more or less subject to milk fever just after calving and the dairyman should be provided with a milk fever outfit. Prompt treatment of this disease is necessary.

Water Supply.—The importance of an abundant supply of pure, clean water cannot be too strongly stressed. In making official tests we often find it desirable to milk three times daily. Our cows are furnished water in a cement trough from a deep well. These cows, while being grazed in one pasture had access to water at will. In another pasture, which, so far as we could tell, was as good as the first, the cows could only get water when brought out for milking. We found it impossible to get the same yield from the cows in the second pasture as was obtained when the first pasture was used, although the cows were watered three times daily.

Often the water in pools is contaminated and unfit for use by the dairy cow. At other times the pools or running brooks may be so far away that the cow fails to get sufficient water for her needs.

Mineral Requirements.—Salt has long been recognized as necessary for all animals consuming large quantities of vegetable food. Salt should be supplied regularly to cows. It may be added to the feed or it can be placed in the trough so that the cows may consume the amount wanted. In the latter case it may be either in granular form or fed as rock salt. In all cases the supply should be regular. The cow also requires other minerals for maintenance and production, but the scientists are not yet agreed as to when these can and cannot be supplied through the feeds given. If a variety of grain feeds are used, especially those containing liberal amounts of calcium and phosphorous, and legume hays are used as the chief roughages, the probabilities are that rations for all except the especially high producers will contain sufficient minerals other than salt to meet the demands.

FEEDING THE DAIRY COW

Importance of Proper Feeding.—The economical production of milk is dependent upon (1) breed (2) feed. Under good conditions, about one-half of the expense incurred in the handling of dairy cows is required for the feed they use. This is the largest single item of expense. The high producer, as shown by Table 1, eats more feed than does the low producing cow, but the other items of expense, such as labor, housing, etc., are about the same for both. The necessity for providing proper feed to secure large production is therefore evident.

Pasture.—Experiments and experience indicate that good pasture furnishes the cheapest feed that can be given to the dairy cow. In any system of stock farming in the state, the pasture as a source of feed should be given first place in importance. A good pasture is indispensible if we are to secure the greatest profits. Figures show that feed may be produced in this way at from one-fourth to one-sixth of the cost of purchased feeds. Before we can expect good pastures to become general over the state, several erroneous ideas must be abandoned, among which are the following: Rich land should not be used for pasture as it cannot be made to return a profit. We should remember that in Holland the land rents for from fifty to one hundred dollars per acre and is very

rich, but the people find it profitable to graze the land with Holstein cattle. Cows are pastured on rich lands on Jersey Island—the home of the Jersey cow—and profitable returns are secured. It is possible in time to make good pasture on poor soils, but this does not prove that rich lands may not be used to advantage for this purpose. There seems to be a general idea that even when poor land is selected that grass grows naturally and no special preparation is needed. To provide a good pasture the land must be put in condition and planted to suitable crops—those that will not only be adapted to the soil, but crops that will be profitable and nutritious, and whose growing period will extend over as much of the year as possible.

Realizing the importance of this subject, the College through its Experiment Station, Extension and Teaching force issued a circular this year giving the basic pasture crops for each of the regions in which the state may be divided on the basis of soil and pasture plant adaptation. The recommendations of this committee for a basal pasture mixture for the long leaf pine region:

Lespedeza	15 pounds
Carpet grass	10 pounds
White clover	3 pounds

Basal pasture mixture for the short leaf pine area, the flat woods, the northeast highlands, and the Pontotoc Ridge:

Bermuda grass, sods	3 by 3 inches in 3 foot checks
Lespedeza	15 pounds
White clover	3 pounds
Hop clover	3 pounds

Basal pasture mixture for limestone soils:

Bermuda grass, sods	3 by 3 inches in 3 foot checks
Lespedeza	15 pounds
White clover	3 pounds
Hop clover	3 pounds
Black medic	5 pounds
Dallis grass	10 pounds

Since it is a generally accepted fact by most farmers that grass will grow under practically all conditions, it is not considered necessary by them to give the pasture any special attention after the land has been set aside for this purpose. Even after good pastures have been started, care and attention are essential if we are to get satisfactory returns. Unless the land has been cleared of under-brush and put in shape for the mower, we have failed to properly prepare the pasture, and until this is done it will be difficult to get or maintain suitable crops for grazing. Pastures should be mowed at least twice a year to destroy weeds and to keep the grasses tender and nutritious. Additional suggestions in making and maintaining a good pasture for dairy cows would be to fertilize the poorer spots in the pasture. Provide hill-side ditches or terraces where needed. Do not graze too early in the spring, nor too close at any season. Provide shade in the pasture for the cows. See that the cows have access to pure, clean water. It is desirable to have the pasture divided so that the cows may be changed from one to the other.

In order to determine the value of pasture for dairy cows, several tests have been made. During the summer of 1924, five cows on good pasture were compared with five cows on poor pasture for a period of 168 days. This test was repeated in 1925 with two lots of four cows each for a period of 161 days. The average results of these two years' preliminary work indicate that a cow on good pasture can secure sufficient feed for maintenance and for the daily production of fourteen pounds of milk testing 4% butterfat. In 1926, a test was made by dividing twelve cows into three lots of four cows each. These cows were fed for three periods of eight weeks each as follows: Lot 1 was on good pasture during the first and third periods and in a dry lot during the second period. Lot 2 was in a dry lot during periods one and three and on good pasture during period two. Lot 3 was on good pasture for all three periods. One week was allowed between each period for making the change from one feed to another. The results of these tests are shown below:

Lots	No. of Cows	Days on Test	FEED			Gain or Loss in live-weight lbs.	PRODUCTION		
			Pasture	Grain, lb.	Hay, lb.		Milk, lb.	Fat, %	Fat, lb.
1 and 2	4	168	None	4,508	10,976	-27	12,142	3.95	479.5
1 and 2	4	168	Good	2,114		529	13,071	3.96	518.4
3	4	168	Good	2,107		365	13,772	4.58	631.7

The average yield per cow per day of the cows in Lot 1 and Lot 2 during the periods of no pasture was 18.1 pounds milk containing 0.71 pounds fat. The same lots on good pasture produced 19.4 pounds of milk containing 0.77 pounds of fat. The cows in Lot 3 that were kept continuously on good pasture produced daily 20.5 pounds of milk containing 0.94 pounds fat. The daily feed for each cow was—Lots 1 and 2 with no pasture—6.71 pounds of grain and 16.33 pounds hay; Lots 1 and 2 with good pasture, 3.14 pounds grain and no hay; Lot 3 with good pasture 3.13 pounds of grain and no hay. If we compare the results where no pasture was provided with those obtained with cows continuously on good pasture, allowing $2.00 per 100 pounds of grain and fifty cents for 100 pounds of hay, with a value of forty cents per pound of butterfat, we find that the feed furnished during the 168 days, or about five and one-half months, by the pasture was worth—compared with purchased feeds—a little over $41.00 for each cow. We also call attention to the fact that while good pasture reduced the amount of grain required and made unnecessary the feeding of any roughage to the cows, some grain was needed. The amount of grain required depending upon the amount of milk the cow is capable of producing. As a general guide, it may be stated that about one pound of grain will be needed for each 2½ to 3 pounds of milk in excess of 14 pounds of milk daily.

Roughage.—The conformation and digestive apparatus of the cow are such as to make it necessary for her to have a considerable amount of roughage and for the high producing cow, especially, this roughage should be of good quality. Her needs along this line may best be met by the use of good legume hays and silage. Results secured by the Station indicate

that there is very little difference in the feed value for dairy cows of alfalfa, soybean, lespedeza, and cow-pea hay. This is shown by the conclusions given in Station Bulletin No. 235, as follows:

1. For the production of butterfat, soybean hay is slightly superior to alfalfa hay.
2. Soybean hay is superior to lespedeza hay for both milk and butterfat production.
3. Alfalfa hay is a little better than lespedeza hay for milk and butterfat production.
4. Mammoth yellow soybean hay is superior to laredo hay for milk and butterfat production.
5. Ground soybeans are better than cottonseed meal or soybean meal as a concentrate for the production of butterfat.
6. Soybean meal is a little less valuable than cottonseed meal as a concentrate for milk and butterfat production.

The above being true, we should grow that legume hay which will give the greatest yields on our soils and which will best fit in with our general plan of farming. Under certain conditions it may be that a good grass hay can be grown so much cheaper than a legume that it might be found more profitable to supply at least a part of the roughage in this form. In such cases, however, this hay should be cut before the grass becomes coarse and woody.

Silage.—In the corn belt, corn silage is recognized as the best and most economical succulent feed that can be grown for winter feeding. While we recognize the value of this crop in this State, corn yields are often low and, if planted late, uncertain on many of our farms. Sorghum, especially the larger growing varieties, will be found more economical than corn because of the much larger yield per acre. The yield of sorghum is often 50 to 100 per cent more than corn and our experiments indicate that sorghum silage has a feeding value equal to 90% of corn silage. From 15 to 20 tons of sorghum to the acre is not an unusual yield. On the same land, eight to twelve tons of corn would be considered a fair crop.

Feeding Grain to Cows.—To feed cows economically they must be fed as individuals and not as a herd. Where all of the cows in the herd are fed the same quantity, some are over-fed while probably more are under-fed. We should recognize that a certain amount of food—usually one-half of a full ration for the average cow—is needed for maintenance. The feed given in excess of this amount is available for milk production, storing of fat on the body, or for growth of the young or immature animal. The milk giving function of the highly bred dairy cow is so strongly developed that the effect of under-feeding may not be noticed by a decrease in yield of milk at once as such a cow will often convert a part of the flesh of her body into milk. If the cow is losing in body weight, except for a short time after calving, it is an indication that she is not getting sufficient feed. Below, we give a few suggestive combinations of grain feeds that should be found helpful in formulating a ration for the cows in the dairy herd. Modifications can be made by substituting feeds of like

composition for those given, provided we keep in mind the fact that in addition to furnishing the proper nutrients, a ration to be satisfactory, must be palatable; it should contain as much variety as possible, and a certain bulk is needed to meet the requirements of the cow. Keeping these facts in mind, it would be possible to substitute for cottonseed meal—linseed meal, soybean meal, or peanut meal; for corn and cob meal—corn meal or corn chops, hominy, or molasses; for wheat bran—crushed oats or rice polish. Doubtless, a part of the feed suggested could often be substituted by other feeds of like character to advantage, thus giving greater variety.

FEED CHART FOR JERSEYS AND GRADE JERSEYS

(1) When roughage is partly legume and partly non-legume (combination of soybean, cow-pea, lespedeza, or alfalfa hay with bermuda, Johnson, or Crab grass hay), and with or without silage. When milk yield is from 5 to 21 pounds daily, feed one pound of the following grain mixture for each 3 pounds of milk produced:

100 lbs. cottonseed meal
100 lbs. crushed oats
100 lbs. wheat bran
500 lbs. corn and cob meal

When the yield of milk is more than 21 pounds daily, feed one pound of the following grain mixture for each 2½ pounds of milk produced:

100 lbs. cottonseed meal
100 lbs. crushed oats
100 lbs. wheat bran
300 lbs. corn and cob meal

(2) When roughage consists of legume hay and sorghum silage, feed one pound of the following grain mixture for each 2½ pounds of milk produced:

100 lbs. cottonseed meal
100 lbs. crushed oats
500 lbs. corn and cob meal

(3) When roughage is all non-legume (bermuda, Johnson, or crab grass hay), cottonseed hulls or silage or a combination of two or more of these, feed one pound of the following grain mixture for each 2½ pounds of milk produced:

300 lbs. Cottonseed meal
100 lbs. crushed oats
100 lbs. wheat bran
300 lbs. corn and cob meal
200 lbs. corn gluten feed

Amount of Feed Required.—Since home grown feeds are usually more profitable than purchased feeds, we should be able to plan our farm crops in such a way as to provide for the needs of the herd. To do this is necessary to know the approximate number of animals to be kept and the amount that will be required for each. The average results in feeding the College herd each year for a period of five years, together with the production should give us some information of value.

Table 3. Record of College Jersey Herd—5 Years Average.

	No. of Yearly Records	PRODUCTION, LBS.		FEED REQUIREMENTS, LBS.								
				GRAIN			HAY			SILAGE		
		Milk	Fat	Per Cow	Per 100 lbs. Milk	Per 1 lb. Fat	Per Cow	Per 100 lbs. Milk	Per 1 lb. Fat	Per Cow	Per 100 lbs. Milk	Per 1 lb. Fat
Entire Herd	335	5,618	279.3	2,163	38	7.7	1,858	33	6.7	3,857	69	13.8
Cows giving 300 lbs. of fat or above	130	7,109	359.6	2,911	41	8.1	1,952	27	5.4	4,022	57	11.2
Cows giving under 300 lbs. of fat	205	4,672	228.3	1,673	36	7.3	1,799	39	7.9	3,753	80	16.4

BULLETIN 260 SEPTEMBER 1928

SHEEP PRODUCTION IN MISSISSIPPI

BY
H. H. LEVECK & D. S. BUCHANAN

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
J. R. Ricks, Director

FOURTEEN POINTS OF SHEEP PRODUCTION

1. Study sheep. Find out what others know about them. Page 2.
2. Prepare for sheep before purchasing them. Page 2.
3. Use purebred rams and build up the flock. Page 5.
4. Make use of temporary pastures to aid in control of parasites, to help keep the flock in a thrifty condition, and lower the cost of wintering. Page 12.
5. Save and raise all lambs. Page 13.
6. Keep flock records and know what each individual in the flock is doing. Page 13.
7. Dock and castrate the buck lambs. Page 15.
8. Protect the flock from dogs. Page 16.
9. Cull the ewe flock. Retain the good type ewes that are heavy wool and milk producers and have the habit of yeaning early. Page 17.
10. Save the best ewe lambs for the breeding flock. Page 17.
11. Provide plenty of water, salt and shade. Pages 17-18.
12. Join a lamb club. Page 18.
13. Prepare wool for marketing and sell both wool and lambs cooperatively. Pages 20-21-22.
14. Use your County Agent, your State Extension Service, and your State Experiment Station. Page 19.

Acknowledgments are due Prof. C. J. Goodell for material left at our disposal and to Dr. C. B. Cain for aid in writing that part of the bulletin on "Sheep Ailments."

PART I

SHEEP PRODUCTION IN MISSISSIPPI

By

H. H. Leveck and D. S. Buchanan

Wool and mutton sales, to insure a profitable sheep husbandry, must equal or exceed cost of production. Wool is a world commodity where production and demand are about balanced and, consequently, increases in population, especially in the colder climates, require increased production for the maintenance of per capita consumption.

Even with mutton and lamb consumption in this country only about one-fourth that of Great Britian, the demand of these products has been sufficient to absorb all offerings at profitable prices. This low consumption is due partly to the poor quality of the product that was formerly put on the market. More recently, more attention has been given to raising and fitting a type of lamb capable of furnishing a higher qualitied mutton. This should result in increased consumption and a tendency towards continued profitable prices.

CYCLES OF PROSPERITY AND DEPRESSION IN SHEEP PRODUCTION

The purchasing power of sheep has been alternately high and low six times during the past fifty years, the cycle being regular in character and having a general upward trend. In the last advance, sheep rose seventy-two per cent in purchasing power, according to G. F. Warren and F. A. Pearson,[1] of Cornell University, who says, "Usually the sheep cycle is much less violent, but the rise during the war, the drop after the war, and the present rise were extremely violent."

Recent prices of wool and lambs have been responsible for a general revival of interest in sheep production, few enterprises during the past few years having shown comparable returns on the investment or for the expenditure of labor. While at present the purchasing power of sheep seems to be close to the top of the cycle, there appears little reason to fear that the well managed flock will not continue profitable.

SHEEP HUSBANDRY IN MISSISSIPPI

The number of sheep in Mississippi on January 1, 1928, was given by the United States Department of Agriculture as forty-five thousand, a decline of approximately seventy-seven per cent since January 1, 1920. These sheep consist largely of natives, though in the norther part of the state, there is an increasing number of mutton flocks. Less than five hundred purebreds were listed in the last census, practically all of which belonged to the Down or mutton breeds.

There are in Mississippi two general forms of sheep husbandry. In South Mississippi, flocks are run on the range, receiving practically no attention except at the time of shearing. With low maintenance costs,

1. Farm Economics No. 31. February 6, 1926.

range men have been satisfied with the profits from wool and wether sales. In the northern part of the state, sheep are handled under fence. Wool sales have been depended upon for carrying maintenance costs, and where flocks have been well tended, the sale of early lambs has netted nice profits. In fact, under average conditions, sheep are the most profitable of all farm animals. It is not unusual for a small farm flock to return more than 100 per cent when handled properly. On the other hand, a disease or a mistake in buying or handling may cause a loss on the investment.

Under proper systems of sheep management, the lime belt area of Mississippi, with its usually mild climate and rich soil, offers exceptional advantages for the production of early lambs.

NEED FOR MORE EFFICIENT METHODS OF PRODUCTION

Notwithstanding the excellent profits from sheep where well managed, unsatisfactory returns are frequently evidenced by the dispersion of farm flocks, indicating the need for greater general efficiency in sheep production. This can and should be accomplished through more generally improved methods of breeding and management.

To be a successful sheep producer and particularly if one is to engage in the early lamb production phase, there are some practices with which one should be familiar. The beginner should familiarize himself with certain phases of the industry before he makes his original purchase; otherwise, he will be defeated before he begins. There are numerous things, of course, that can only be learned by actual experience in the business.

It is the purpose of this bulletin to outline the answers to some of the problems of sheep production in detail by successive steps in a simple, untechnical language that can be understood and followed by the beginner.

The recommendations herein are based largely on a study of sheep breeding and management at the Mississippi Experiment Station. The results of the data gained by experimentation at this station are given in Part II. Where other material has been used in an effort to enhance the value of this publication, credit is given in the text and in foot notes. A list of helpful references is also cited.

Care and Management of the Flock

BEFORE PURCHASING SHEEP

The first thing that the prospective sheep man should learn is that sheep cannot take care of themselves and that they are not "scavengers" to the extent that they will return a profit without any care and attention; however, they will consume more than ninety per cent of the plants considered as weeds and therefore are especially useful for keeping down weeds on the farm. Sheep, as well as all other domestic animals, must receive the right kind of care and attention at the proper time.

The prospective sheep producer should read up on the references cited. He should visit successful sheep producers and see and talk to them about their methods. Many things may be learned that can be used later and often it may be learned that one is not ready to begin.

EQUIPMENT NEEDED

Fences.—Too often the breeding stock is purchased and brought to the farm before preparations are made to receive it. It is well to make a study of the equipment needed before purchasing and have all of these preparations made before bringing the flock to the farm.

The first thing to be considered is the amount of land that can be devoted to the farm flock. Under average Mississippi farm conditions, a small flock could be added to the present livestock population without overstocking. If a certain acreage is to be devoted entirely to sheep production, the assignment may be made on the basis of the carrying capacity in terms of cattle. The cattle carrying capacity is usually known. Five to seven mature sheep may be grazed on the acreage usually allotted to one mature cow, depending on the king of grazing available. The ideal arrangement for sheep farming would be to have sufficient pasture acreage to have two pastures of equal size so that one pasture may be used one year and the other pasture the next. This will be a great aid in controlling the parasites to be discussed later. Temporary grazing for winter use may be utilized to a great advantage and profit.

All acreage where sheep are to be grazed should be sheep-proof. The fence would not have to be as tight as for hogs, but the better the fence, the smaller the chance for trouble with dogs. If the pasture is not near the barn, it will be necessary to build a small corral that will protect the flock from dogs. This corral may be made of net wire and barbed wire or barbed wire alone. It should be constructed so as to prevent a dog from scratching under, going through, or climbing or jumping over. It is well to set one or two strands of barbed wire at an angle and to the outside of the top strand as shown in the accompanying illustration.

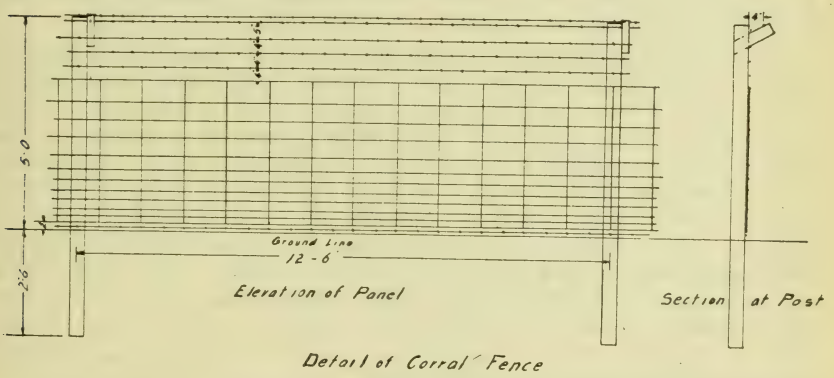
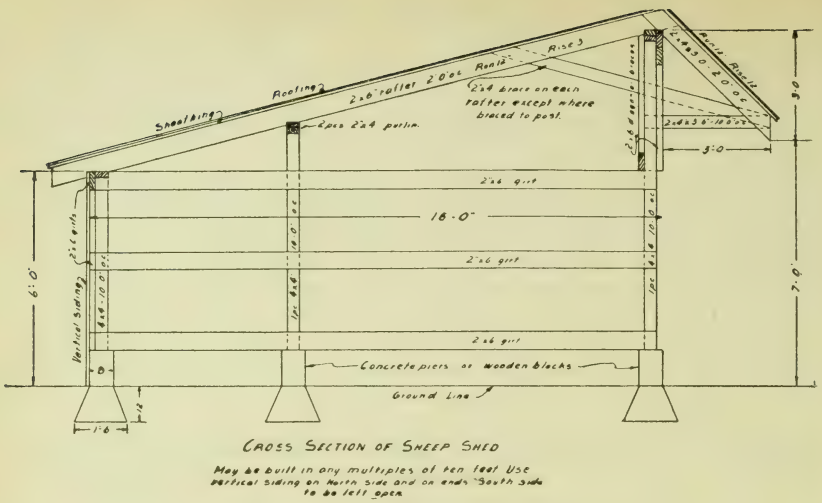


Fig. 1. A Dog-Proof Sheep Corral. (Drawing by Agricultural Engineering Department.)

SHEDS

Expensive sheds are not necessary for sheep. Any kind of a shed that will afford protection from the wind and rain will be sufficient. Sheep are affected very little by cold weather as long as they are kept dry. There is usually some barn space that may be allotted to the flock. If a shed has to be constructed especially for the farm flock, the following type is recommended as being simple in construction and inexpensive.



CROSS SECTION OF SHEEP SHED

May be built in any multiples of ten feet Use vertical siding on North side and on ends South side to be left open

Fig. 2. An Inexpensive Sheep Shed.
(Drawing by Agricultural Engineering Department.)

In building a shed for sheep, one must be sure to allow for plenty of ventilation and light, as a poorly ventilated or lighted barn is worse than no barn at all. The sheep shed should be located on high ground so as to provide drainage. A place that is well drained can be kept clean and dry. As sheep suffer more from dampness than from cold, it is very important that they be kept dry.

Sufficient space should be allowed when planning the barn to provide at least twelve square feet for each mature sheep, this space to be exclusive of that required for feed troughs and storage room.

With our mild climate, an open shed facing the south, with plenty of depth to give protection from blowing rains, will fulfill these requirements. One of these sheds is shown in Figure 2. The length of this shed will be governed by the number of sheep to be kept in it. Where a closed barn is used, ventilation and light must be provided. By having windows hinged from the bottom and allowed to swing in, drafts are prevented. Doors should be wide to prevent crowding. It is much better to have one eight-foot door than two four-foot doors. All doors should be provided with hooks and fastened back when opened to prevent them from closing on sheep as they crowd through. Where sills extend across the doorway, they should be close to the ground; otherwise, sheep will have to jump them upon going through the doorway. Narrow doorways and high sills are especially dangerous to pregnant ewes.

Barns or sheds should be dog-proof, or better still, surrounded by a dog-proof fence, giving a lot where the flock may bed in dry weather. (If this is the only available lot, there should be some twenty-five square feet per ewe to supply room for exercise.)

Sheds may be conveniently divided into smaller units, catch pens, and lambing pens by the use of movable hurdles. These hurdles should be made of light material so as to be easily handled. They should be about forty inches in height, and the length to correspond to the needs for that particular barn or shed.

OTHER EQUIPMENT

When grain is to be fed, a flat-bottom trough will be required. A good trough is one that is 8 inches in width and 4 inches in depth. The trough should be of sufficient length to allow one foot of length for each sheep.

A hay rack should also be provided. Some recommend a combination trough and rack. This will cause some damage to the wool by the particles of hay dropping down into the neck wool while the sheep feed below. The trough and rack illustrated below will eliminate a greater part of this trouble.

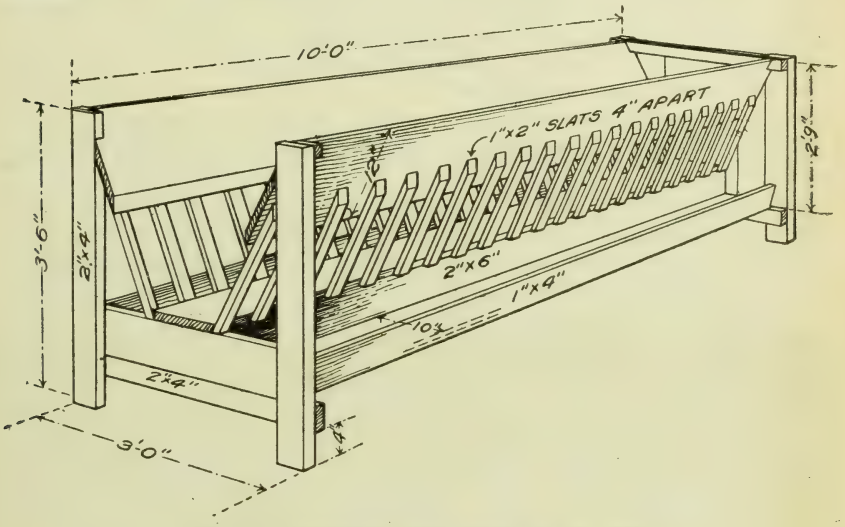


Fig. 3. A Combination Feed Trough and Hay Rack.
(From Bureau of Animal Industry)

BREED TO SELECT

"There is no best breed of sheep." However, some of the breeds are better adapted to southern conditions than are others. It is not unwise for the beginner to start out with native Mississippi ewes and a purebred ram of one of the approved breeds. Mistakes, if made in this undertaking, would not be so costly. These native ewes have their good qualities, which in a measure, are transmitted to their offspring and these, coupled with the mutton qualities of the well-bred ram, make an ideal combination for a farm breeding ewe.

These native ewes are cheap; they are strong and hardy; they are especially good milkers and are adapted to the locality. The original investment is not only small, but there is usually quite a saving in freight rates if these ewes can be purchased locally in preference to going out of the state to purchase the foundation flock.

By putting a purebred ram on these ewes and saving the best ewe lambs each year to add to the breeding flock to increase it in size and also to replace the native ewes as they wear out, only a very short time will elapse before a high-grade ewe flock can be established.

For early lamb production in Mississippi, it is believed that either Southdown, Hampshire, or Dorset Horns would give the best results. When Dorset Horns are crossed on native ewes, early breeding habits and other desirable qualities are gained, yet this cross is lacking in compactness and natural fleshing desired in early lambs. Therefore, then, when this cross is made, it is recommended to follow with a Southdown ram to overcome these faults.

THE SOUTHDOWN

The Southdown is a model of mutton type. They are short of leg, broad and strong of back, deep of body and compactly built. Due to its thick covering over back and loin, and fullness of hindquarter, the Southdown is unexcelled as a killing sheep. The head is short and broad and the face straight. The ear is short and erect and free of wool. The wool extends to, but does not meet below, the eye. The wooling should extend down to the knee and hock and that part of the face and legs that is not covered by wool and the ears should be from a steel gray to a light brown in color.

The wool of the Southdown is fine, clean and should measure for a year's growth about 2 or 2.5 inches. A purebred flock will produce on an average of 5 to 8 pounds of wool. Mature rams should weigh from 185 to 220 pounds and ewes from 135 to 150 pounds.

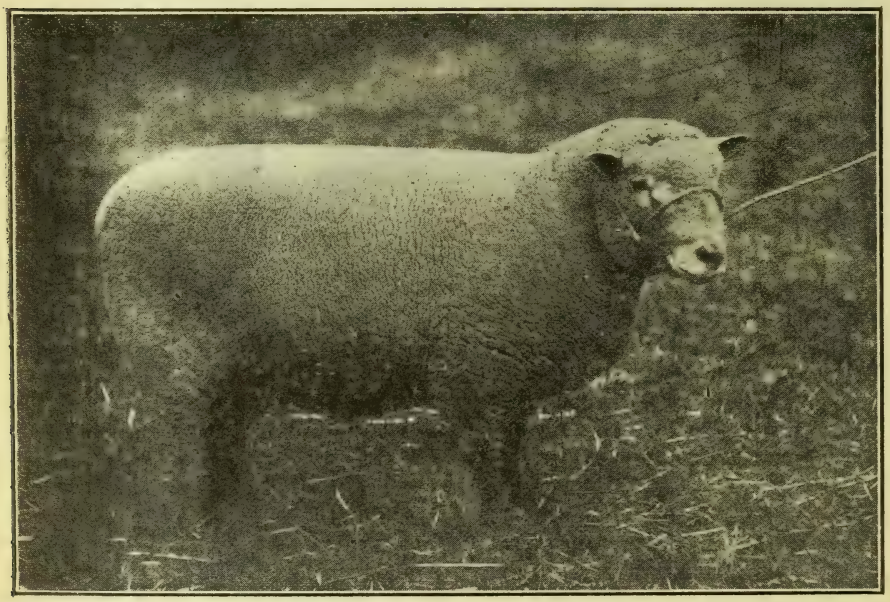


Fig. 4. A Purebred Southdown Ram.
(From Bureau of Animal Industry)

THE HAMPSHIRE

The Hampshire is a much larger breed than the Southdown, but somewhat similar in body conformation. The breed is massive and growthy

and consequently is not as short of leg and compact of body as the Southdown. The head of the Hampshire is large with a tendency toward a Roman nose. It is wooled down to a point below the eye, and the ear is large, free of wool, and is set almost horizontally to the head. The face, ears, and legs from knee and hock down, vary in color from a dark brown to almost a black. The fleece is white and should be about 2.5 inches long, although somewhat coarser than the fleece of the Southdown. A year's growth should weigh from 6 to 8 pounds. Mature rams weigh from 250 to 300 pounds, and mature ewes, 180 to 225 pounds. The Hampshire, due to its size and rapid growing quality, is especially well adapted to increasing size of native sheep, although the lambs will not finish quite so early as Southdowns.

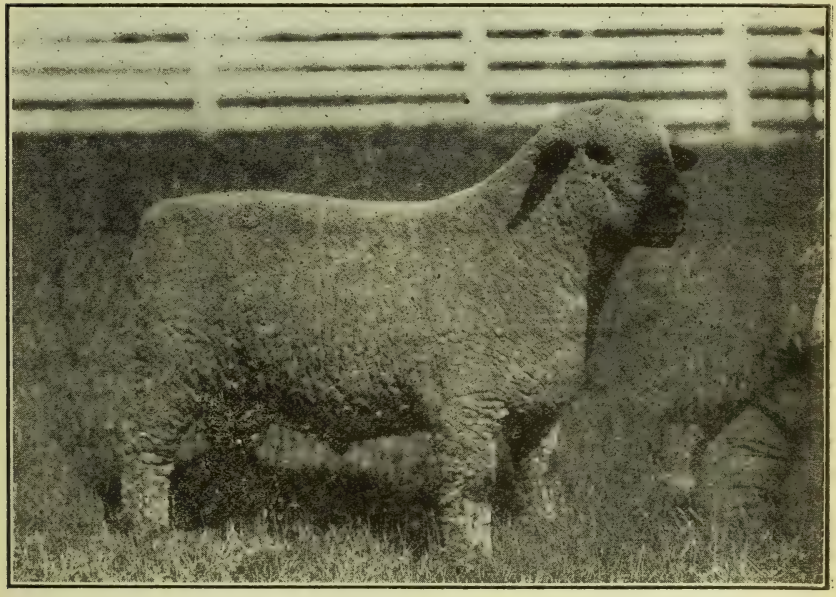


Fig. 5. A Purebred Hampshire Ram
(From Bureau of Animal Industry)

THE DORSET HORN

The Dorset Horn, due to its early breeding qualities and prolificacy, has met with much favor as a producer of early lambs. It is between the Southdown and Hampshire in size. Mature rams should weigh approximately 275 pounds and mature ewes from 180 to 220 pounds. It does not conform quite so closely to mutton type as either the Southdown or Hampshire. The Dorset Horn is sometimes criticized for being too long of leg and shallow of body. The face, ears, and legs from knee and hock down, are bare of wool. The wool of the forehead forms a compact tuft or foretop of wool. The markings are white. The fleece should be about two and a half inches long and average about 6 pounds in weight. Both rams and ewes have horns.

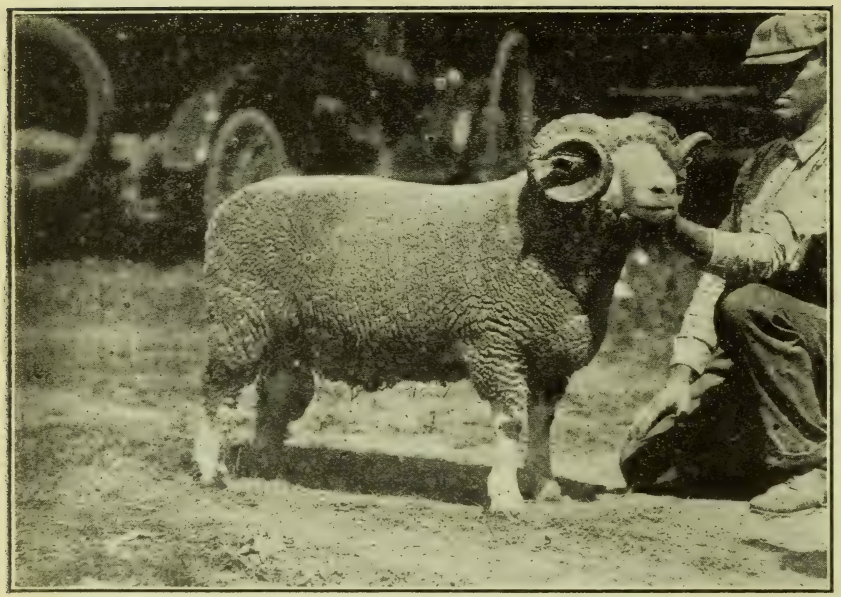


Fig. 6. A Purebred Dorset Horn Ram.
(From Bureau of Animal Industry)

SELECTION OF THE EWE

There are several points to be kept in mind in selecting the ewe flock. Only those that conform closely to the mutton type should be selected. The deep-bodied, wide-chested kind will prove to be the most hardy and thrifty. Only from this type of ewe can the early maturing mutton type of market lamb be produced.

Uniformity is a big factor that must be secured in the breeding flock. It is to be remembered that only one ram is to be selected for each unit of approximately thirty ewes. These ewes, to get the best results when mated to this single ram, should be as uniform in type and quality as the source of selection will permit.

Only thrifty, active ewes should be purchased. Avoid the ewe with a hanging head and a listless appearance. Raise the eyelid and note the color of the eye. The healthy normal eye will show a bright color with the blood vessels plainly evident.

If one is to engage in the production of purebred sheep, the yearling bred ewe is the ideal age for the foundation ewe. The purchaser of this kind of ewe probably gets more for his money than any other kind. For a grade flock, older ewes may be purchased to an advantage. Broken-mouth ewes should never be purchased by the inexperienced sheep man.

Select ewes with good udders. This may readily be determined by examination. The sound udder will be soft, pliable and free from lumps or cores.

TIME TO BUY EWES

Bred ewes, of course, will be bought in the early fall. Plenty of time should be allowed after the rams have been turned with the flock before

the selection is made so as to be sure that a bred ewe is selected. September and October are good months in which to purchase bred ewes.

Native sheep should always be bought open, as the native lamb has little comparative value. Since it is recommended that for early lamb production the rams be turned with the ewes about July first, it will be necessary to purchase them prior to this time.

SELECTION OF THE RAM

The flock ram is more than one-half of the flock. The mistake should not be made of selecting an inferior sire, even though he is to be used on a grade flock. The cost of one ram for each thirty ewes cannot be so much but that the purchase price will be well within the range of anybody's pocketbook. The type of ram to be selected will depend in a great degree on the type of the ewe flock. He should be selected for the purpose of building up the quality of the ewe flock as well as for correcting their defects of type. He should in every case be the growthy kind, with plenty of substance of bone, strong of constitution and of superior mutton type.

DETERMINATION OF AGE OF SHEEP BY THE TEETH

The age of sheep as indicated by the teeth can be determined with a fair degree of accuracy. The method is simple and should be known by every sheep man. The front or incisor teeth are found in the lower jaw

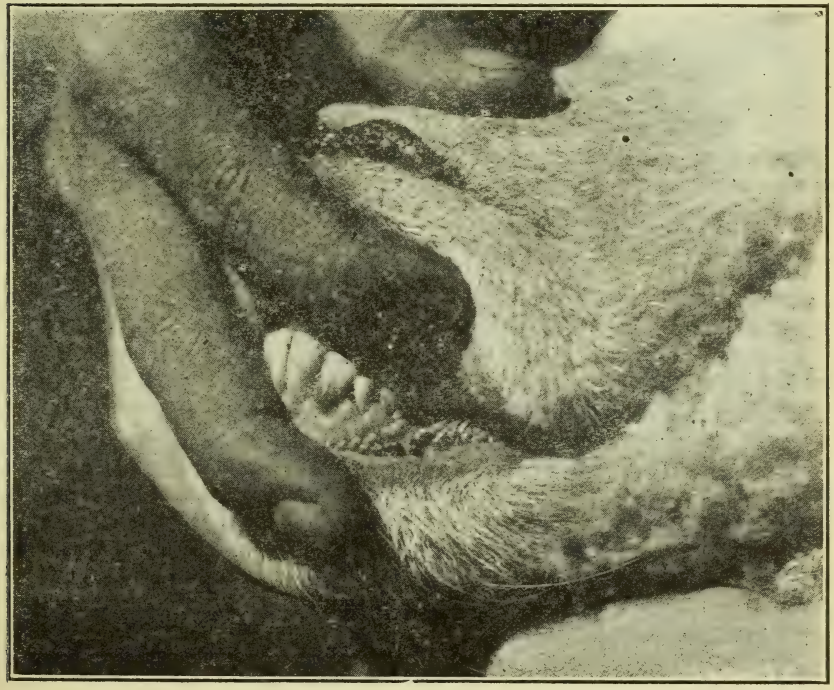


Fig. 7. A Two-Year-Old Mouth
(From Bureau of Animal Industry)

only, and are eight in number,—four pairs. The first set are temporary and are called lamb's or milk teeth.

The middle pair of permanent teeth replace the middle pair of temporary by the time the lamb is about fourteen months of age. Note the difference in size and shape between the permanent and temporary teeth.

A two-year-old mouth will show that the two center pairs of permanent teeth have replaced the two temporary pairs. A three-year-old mouth will show three pairs of permanent teeth and one of temporary. At four years of age, all of the temporary teeth have been replaced by permanent ones. With age, the teeth usually begin to spread and begin to wear or break. The teeth usually begin to break and come out at about seven years of age. Sheep of this age have passed their period of usefulness and should not be kept unless the animal be an exceptionally good breeding animal.

BREEDING

The Ram.—The ram should be kept away from the ewe flock other than during the breeding season. Any good grazing area that will furnish plenty of good grazing and allow exercise is the best possible environment for the breeding ram. It will sometimes be necessary to feed a small amount of grain to get him in breeding condition. The ram should go into the breeding season in a strong, vigorous condition. He should not be too fat. Rams of any age may be run together. In fact, it is best to have the rams together. Ram lambs are sometimes used as breeding rams, but this is not a good practice unless the lamb has been especially well cared for and is growthy and strong for his age, and then bred only to a very limited number of ewes.

To insure a large lamb crop, not more than thirty ewes should be allowed for each mature ram. It is false economy under pasture breeding management to put too many ewes per ram. The number of ewes per ram according to age under the pasture management system is given below:

Mature rams	30 to 40 ewes
Yearling rams	20 to 25 ewes

The Ewe.—The ewe lamb that is dropped early will come in heat late in the season. It is not a good practice to breed the ewe lamb and if practiced, will result in a lack of size, uniformity, and vigor. Better results will be obtained if the ewe lamb is not bred until the second summer.

The ewe that has suckled a lamb during the spring will if on good pasture, be in good condition by the opening of the breeding season. For ewes that are a little low in condition, it is a good practice if possible to shift them to a new pasture. Under certain conditions, it will be necessary and profitable to give them a little feed.

This practice is called "flushing", and usually results in the ewes coming in heat early and causes a larger number of twin lambs to be produced. Marshall and Potts[1] state that there is no decided advantage in the kinds of feed used in flushing, except a saving in labor and expense when pasture is used. Pasture should be used to the fullest extent, but additional grain should be given when necessary.

1. U. S. D. A. Bul. No. 996.

Pasture breeding from a practical standpoint under southern conditions should be followed. If purebred sheep are being produced, one of two methods must be followed in order that the identity of the sire may be recorded. The two methods are hand breeding and pasture breeding by dividing the flock into as many groups as there are rams to be used.

If under the pasture breeding method the breeding date is desired, it may be obtained by letting the ram run with the ewes at night only. Each evening the brisket and chest of the ram should be painted with a mixture of lampblack and a light lubricating oil before he is turned in to the flock. Next morning the ewes that have been marked may be identified and the date recorded. These ewes should not be removed from the flock unless they are to be returned to the ram at the time their next heat period should occur. Heat periods normally occur in sheep at about 18-day intervals, the period usually lasting about three days if the ewe is not bred.

TIME TO BREED

The period from breeding time to lambing time is known as the gestation period and in ewes is about 147 days. The following chart may be conveniently used for determining the lambing date when the breeding date is known:

SHEEP GESTATION TABLE

Date Bred:	Date Due to Lamb:
July 1	November 25
July 10	December 4
July 20	December 14
July 30	December 24
August 1	December 26
August 10	January 4
August 20	January 14
August 30	January 24
September 1	January 26
September 10	February 4
September 20	February 14
September 30	February 24
October 1	February 25
October 10	March 6
October 20	March 16
October 30	March 26

Example of how to use: If a ewe is bred on July 24th, she would be due to lamb on December 14 plus 4 days, or on December 18.

In early lamb production, the breeding season should be limited to from July 1 to November 1. Late lambs are not profitable, so should be prevented by removing the rams from the flock by November first.

FEEDING THE PREGNANT EWE

The pregnant ewe will not require any feed other than pasture as long as the pasture is good. Pastures in this area in average years will need to be supplemented about November. The ewe should not be neglected at this time. Additional feed will be necessary to develop the growing foetus. This period, along with the suckling period, is the critical stage in a lamb's life and the importance of this is too often overlooked. If the

pasture is away from winter quarters, it will usually be necessary to bring the flock in by December first. Good roughage should be utilized as far as possible for feeding the pregnant ewe. Legume hays, such as alfalfa, clover, etc., due to their high protein and lime content, are especially valuable for this purpose, and if available, little or no grain will be necessary.

The following rations are suggested:

RATION 1

Pasture

2/3 lb. alfalfa, clover, lespedeza, cowpea, or fine-stemmed soybean hay.

RATION 2

1/2 lb. oats,

2/3 lb. alfalfa, clover, lespedeza, cowpea, or fine-stemmed soybean hay.

RATION 3

1/2 lb. corn.

1/8 lb. cottonseed meal.

1 1/2 lb. Johnson grass or Sudan hay.

Silage is a good feed for the pregnant ewe when fed in limited amount. Two to three pounds of silage will replace one pound of hay.

TEMPORARY PASTURE

A temporary pasture is a cultivated crop used for grazing land, as the name implies, the grazing season lasts for a limited time. Temporary pastures for sheep may be classified as summer grazing and winter grazing.

Under average Mississippi conditions, permanent pastures will be more economical in the summer than will temporary grazing crops; however, when permanent pastures are limited and in rotation practices as control for parasites, summer temporary pastures fit in very nicely.

In the following table are listed the cultivated plants that may be used for grazing with the dates for planting, amount of seed to be planted, whether planted in row or broadcast, and approximate time to begin grazing. The data is for average Central Mississippi seasons, and would vary somewhat according to seasonal variations for areas north or south of Central Mississippi. The length of time that these crops may be grazed is dependent on the kind of season and the number of animals to be grazed.

Plant	How Seeded	When to Seed	Amount of Seed per Acre	Begin Grazing
Oats	Broadcast	Sept.-Oct.	2.5 to 3 bu.	January
Rye	Broadcast	Sept.-Oct.	2 bu.	December
Wheat	Broadcast	Sept.-Oct.	2 bu.	January
Rape Dwarf Essex	Row	Sept. and Feb.	6 to 10 lbs.	Nov. and May
Cowpeas	Row	Apr.-July	½ bu.	July-Sept.
Soybeans (Mammoth Yellow)	Row	Apr.-June	½ bu.	July-Sept.
Soybeans (Laredo)	Row	Apr.-June	½ peck	July-Sept.
Sudan Grass	Row	Apr.-May	14 lbs.	June

At no time should these crops be grazed so heavily as to destroy the plants nor is it advisable to graze small young plants while the ground is wet.

Alfalfa, sweet clover, and lespedeza, although not strictly temporary grazing crops, may be utilized as such. These crops are more often used for hay crops, but are sometimes used for grazing in winter and early spring before hay time. Alfalfa very often causes bloat; therefore, must be grazed cautiously.

Temporary pastures are especially valuable for the pregnant ewe and are excellent for both the ewe and the lamb after the lambs are dropped. The winter pasture not only keeps the bowels open and the appetite keen, but insures plenty of exercise and will reduce the winter feed bill. Rape, oats, rye, and wheat can be sown in the fall and grazed in the winter.

LAMBING TIME

Lambing time is a critical time in sheep production. Every lamb should be saved if it is at all possible. Only in exceptional cases will a ewe need help in delivering the lamb. It is not necessary to remain on hand at lambing time, but the barn should be visited regularly.

The best practice is to have the ewe in a lambing pen before she yeans. If this is not practiced, the ewe and lamb should be separated from the flock and kept together until the lamb is strong enough to keep up with its mother. Some ewes will not accept their lambs, but this is largely prevented by the above practice. Lambs may be dropped on the pasture if the weather permits, but every precaution should be taken to insure the lambs not being dropped outside in inclement weather. The new-born lamb is very subject to chilling and this should be prevented. In the event that it happens, the lamb may often be saved by immersing him in warm water, rubbing him dry and placing beside a fire.

Weak lambs may often be saved by being assisted to suckle or being fed with a spoon a small amount of its mother's milk. Orphan lambs may be raised on undiluted cow's milk, or if a ewe loses a lamb, skin it and tie the pelt around the orphan and, in most cases, it will be accepted by the new mother. Orphan lambs can be taught to drink milk from a pan or pail as calves are taught to drink. The young lamb can go with the flock, but should be kept inside in bad weather.

The feed of the ewe for 2 or 3 days after lambing should be limited and the heavy milking ewe should be watched and milked when necessary to prevent her udder from spoiling.

SHEEP RECORDS

As soon as the lamb is yeaned, it should be marked for identification. Purebred lambs are usually given a number and are tagged with a metal tag in the ear. Grade lambs should be marked and an ear-notch system will be found to be very satisfactory. Records of age, lambs produced, wool clipped and twins produced should be made of all flocks. This is the only way to build a flock properly.

The Lovejoy system of hog marking is a very satisfactory method to use. One notch in lower rim of right ear has a value of 1, one notch in upper rim of right ear a value of -0, one notch in lower rim of left ear a value of 3 and one in the upper rim of left ear a value of 30.

Fig. 8. A System of Ear Marking.

For example: A lamb marked as shown would be No. 44. To make it 75, one notch should be made in the upper rim of the left ear and one in the lower rim of right. By making as many as three notches in each part of each ear, as many as 132 lambs could be marked by this system. These notches may be made small in the lamb, and when the lamb is mature, the marks will be easily visible.

FEEDING THE EWE AND LAMB IN WINTER

The ewe can be continued on the same feed as she was receiving before lambing. More feed, however, will be required.

Temporary pastures are especially valuable at this time. Constipation is very likely in both the ewe and lamb when the suckling ewe is being fed on dry feeds. The succulence of the pasture will be a big factor in preventing this trouble. Pastures also stimulate milk production and will, at the same time, insure plenty of exercise and fresh air, which cannot be secured when the ewe and lamb are confined to the barn and fed on dry feeds.

The lamb will begin to eat when about two or three weeks of age. At this time a creep should be constructed. This is a small pen with openings through which the lambs may enter, but through which the ewes cannot go. In this creep, alfalfa or clover hay and a grain ration may be placed.

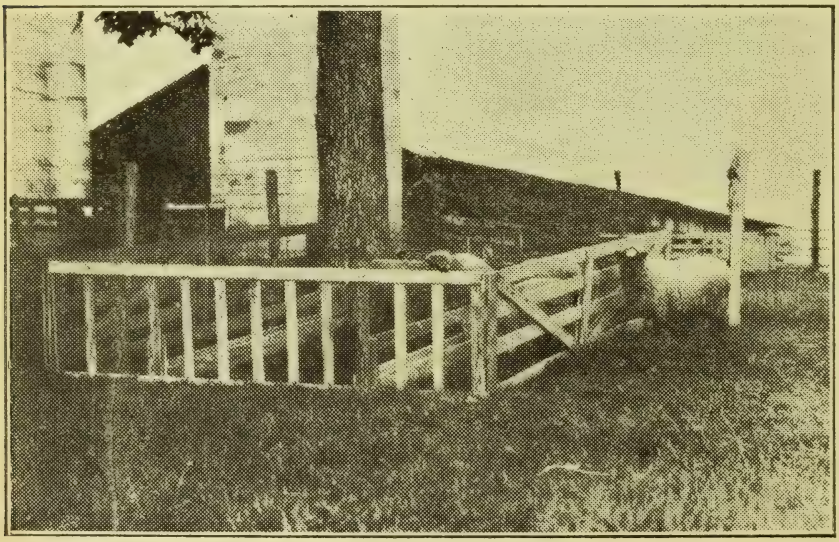


Fig. 9. A Lamb Creep.

The lambs will consume a very small amount of grain, which should be placed in a low flat-bottom trough daily. The following rations are suggested for lambs:

1. Equal parts bran and ground oats.
2. Equal parts bran, ground oats and crushed corn.
3. Crushed corn and alfalfa hay.
4. Crushed corn, 3 parts. ground oats, 1 part; wheat bran, 1 part; and choice cottonseed meal, 2 parts.

FEEDING SUCKLING LAMBS ON PASTURE

Although definite conclusions have not been drawn, work at this station indicates that where lambs are yeaned early and good pasture is available, feeding the suckling lamb on pasture is not profitable. Probably in the areas outside of the lime belt, a grain allowance would prove profitable. In the light of our present knowledge, it is recommended that in the case of a late lambing season, or lack of grazing, grain be given in addition so as to get the lambs on the market before the usual break occurs.

CASTRATING AND DOCKING LAMBS

Both of these operations are simple and necessary; therefore, should not be neglected. Both operations can be performed with least trouble to the operator and least harm to the lamb when the lamb is about two weeks of age.

In castrating, the simple precautions of having the knife and the hands of the operator clean should be taken. The testicles should be forced away from the end of the scrotum and the tip end of the scrotum cut off with a sharp knife. The testicles are then pulled out through the hole and the cord broken by holding with one hand as far up to the scrotum as possible and pulling with the other. A second method is scraping the cord off with a knife. An emasculator may be purchased and used for severing the cord. An emasculatome, an instrument for performing a bloodless operation, may be found economical for use in large flocks or by members of a club.

A good disinfectant for the wound and for cleaning the hands and knife before each operation is a 2 per cent solution of any of the coal tar disinfectants, such as Kreso and Creolin.

After castrating, the lamb should be kept quiet and watched for excessive bleeding.

Docking should be done at the same time as castration. The tail should be removed at a joint one inch from the body. It may be done with a sharp knife or by placing the tail on a smooth board or block and cutting off with a chisel. In either method, the skin should be pushed up on tail toward the body so that it will hang over the wound. Use the same disinfectant as used for castrating. If either operation is done in fly time, it will be wise to use pine tar on the wound as a fly repellant.

In many areas tetanus or "lockjaw" is very prevalent. To prevent this, lambs when docked and castrated, should be kept on pasture and out of dirty barns, and especially horse stalls. Antitoxin may be used on valuable lambs.

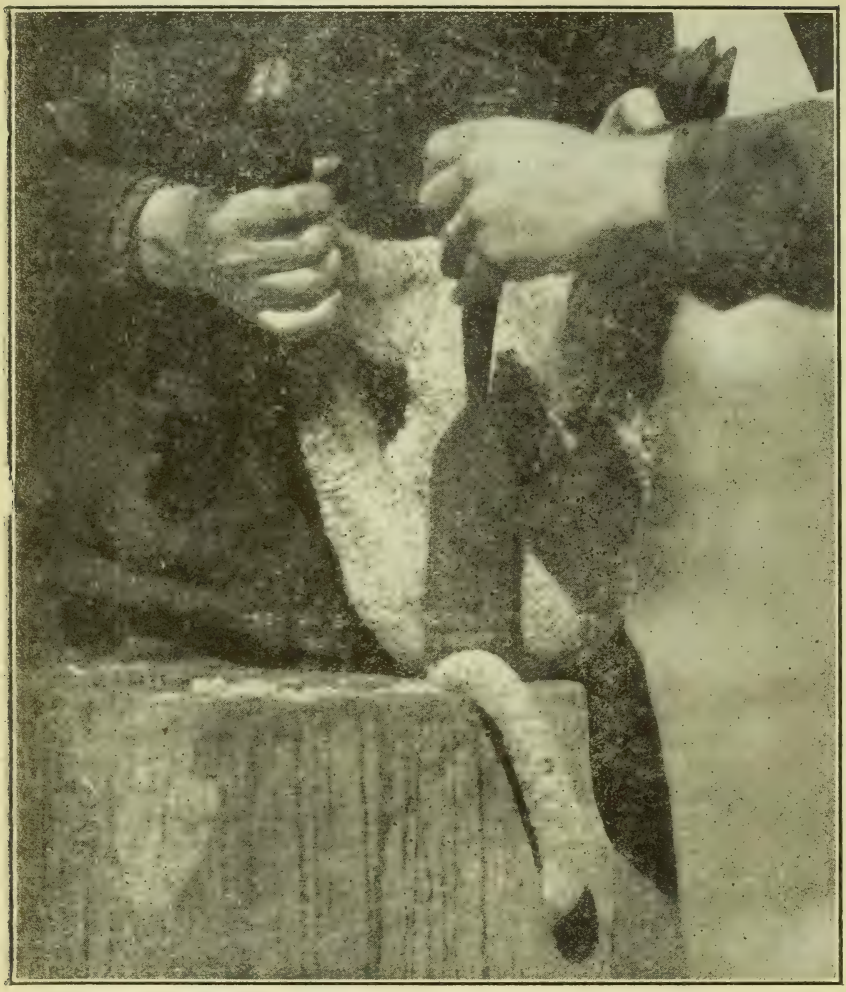


Fig. 10. Docking a Lamb with a Chisel.

DOG PROTECTION

The pasture season is the open season for dog trouble with sheep. As long as the sheep are in winter quarters, or near the farmhouse, the loss from dogs is not so great. It is almost impossible under the existing conditions to pasture sheep at night and not suffer a loss by dogs. A pair of dogs may destroy half of a farm flock in one night. The sheep must either be driven into the shed, or, if the pasture is not near the barn, a dog-proof corral must be constructed as outlined under fencing and equipment. No doubt, in the future the dog menace will be lessened by proper legislation.

WEANING LAMBS

In early lamb production, the lambs should not be weaned until they are ready for market. This will mean that the early lamb be weaned about May 15 to June 1. It is a good practice to wean all lambs at this time. The ewe that yeans late and is allowed to suckle her lamb beyond early June will more than likely yean late the following year. When the lambs are not intended for the early market, they are usually weaned at 4 to 5 months of age.

Heavy milking ewes should be milked two or three days after the lambs are removed; otherwise, a caked udder will result. Many good ewes become worthless when this point is neglected. If an udder should become inflamed, it should be milked out frequently, massaged, and it may be softened by steaming with hot wet cloths.

CULLING THE EWE FLOCK

As soon as the lambs are weaned is the time for culling the flock. The ewes that did not produce a lamb the preceding year will be fat enough for the market, but the others will have to be carried until fall. However, if not culled at this time and marked, they may not be identified later. In addition to the non-breeder, the poor milker and old worn-out ewes should be culled.

SELECTING THE EWE LAMB FOR THE FLOCK

The practical way to build up the flock is to retain the best ewe lambs. In addition to the points named under the paragraph, "Selecting the Ewe", the following points should be considered in selecting the ewe lamb.

The first is the record of the wool clip of the mother. Select the lamb of a heavy shearing ewe. This is a sure way to increase the average weight of the wool clip.

Twin lambs should also be selected. It is commonly believed that a ewe born a twin will more often produce twins than one not born a twin.

The growthy, fast-growing lamb is the one that will be the early maturing lamb. This kind is usually from a good milking ewe, a characteristic which is inherent, and an effort should be made to fix it in the breeding flock.

It is important that the early yeaned lamb be selected for the breeding flock. The yeaning date is, of course, determined by the breeding date, and the habit of breeding early is a point most desired in a market flock. The early yeaned lamb will also have the advantage of size over the late lamb. The large, strong lamb is more resistant to parasitic infestation and other summer troubles.

WATER

Fresh water should be available for sheep at all times, or at least twice daily. When sheep are to be watered from troughs or tubs, these vessels should be kept clean, as a sheep is very particular in its habits.

SALT

Common salt is a necessary requirement for sheep. In fact, sheep, when self-fed salt, will consume more in proportion to their live weight than any other class of farm animal.

Under average corn-belt conditions, it has been found that fattening lambs, when allowed free access to salt, will consume approximately one-fifth of one ounce daily, and pregnant ewes in the winter season, about two-fifths of one ounce. Salt may be mixed with the feed, but it is probably better to keep it before them at all times. This fact is too often overlooked in sheep production, especially under pasture conditions. A block should be kept in the winter quarters and in the corral in summer time. It is estimated that ten cents will buy enough salt to provide for one mature sheep's requirements for one year.

SHEEP CLUBS

Shade is very necessary for sheep in the summer time, and if natural shade is not available, a brush or straw arbor can be constructed with little time and at a very small cost.

SHADE

Cooperation is the keynote in successful lamb production. The possibilities of successful early lamb production by only a man here and there are limited. A number of these limits may be removed and the profits increased by cooperation.

In the first place, a satisfactory plan of marketing cannot be made unless marketing can be accomplished in car-lots, except occasionally as in the case of a man selling to a hotel or cafe. In a cooperative lamb club, much uniformity could be gained in the products by all members using the same breed and by managing so that all lambs would be dropped at about the same time. This insures a uniform product as to age, breeding, and finish. In this manner, a far more suitable market could be found with more satisfactory prices. Freight rates would also be lowered.

The lamb club offers other possibilities in cooperation. One of these is the trading of flock rams. Very often a desirable ram cannot be used on the flock because it is being improved or enlarged by adding his daughters to the flock. If a sale cannot be made, this ram has to be sacrificed to the butcher. This would not be necessary, as more than likely another member of the club would have use for just such a ram for the same reason and a trade could be made.

In a small flock, it is necessary to clip by hand. Even in a small flock, this is laborious and also reduces the price of wool. By cooperation of the club members, a clipping machine may be purchased at a nominal cost per member. A power machine even may be found profitable in a club of sufficient size.

Cooperation may be practiced in selling wool. A premium may be obtained in selling wool if a quantity can be assembled. Pooling the wool, grading and sorting it after assembling offers great possibilities in marketing wool.

An important phase of the lamb club idea is the progress that can be made and the knowledge gained by the membership of a cooperative club. No business can be built up solidly from the ground without a thorough knowledge of that business, gained by a complete and detailed study. The lamb club offers the opportunity for such a study of the sheep industry.

The County Agent would be glad to assist in organizing such a club, and would be of assistance in obtaining information on such subjects as marketing, disease control, and wool pools.

SHEARING SHEEP

The time of shearing is governed by weather conditions. As a rule, shearing can be started any time after Easter Sunday. There is no advantage in waiting until hot weather to shear, even though the fleece contains more oil then. The buyer, realizing this, pays less or pays in proportion to the oil content. In fact, it is generally thought that milk is increased by early shearing. This is probably due to the flock being more comfortable in the increasingly warm weather. Shearing twice a year is very seldom practiced, as the staple is shorter and, even though there is more poundage, the price rarely justifies the extra trouble. Lambs are rarely sheared until they are yearlings. Sheep should always be dry when sheared.

PLACE TO SHEAR

Shearing should be done on a smooth, clean, dry plank, floor, or table. Shearing on the ground permits dirt and trash to get in the fleece, thereby lowering the sale price.

METHOD OF SHEARING

There are two methods of shearing sheep. One is that of tying the sheep down to a table by its neck and legs, laying it on its right side with its head to the left of the shearer. Start shearing by shearing up the left hind leg, over the side, back, belly, shoulder, and neck; then untie the head and shear the remainder of the neck and the head. Untie the forelegs, and turn sheep on its left side. Tie the head in the same place as before. Complete the shearing by finishing the other side, starting with hind leg and working forward. The second method is to set the sheep on its rump, resting its back against the shearer's knees, tilting it back so that its hind legs are free from the floor to prevent struggling. The wool is taken off by shearing from the head, throat and down the belly. The wool is then removed from the neck, side and back in long, sweeping strokes. The sheep is generally turned on its side to remove the wool from over its rump. Of the two methods, the former is perhaps the easier for the beginner, but the latter is by far the quickest method. Shearing may be done with hand shears or with a sheep-shearing machine. The latter is preferable because the wool can be cut closer, giving a longer staple; there are fewer second cuts, giving uniformity to the length of staple and smoothness to the shorn sheep; the shearing is done much faster; and there is less danger of cutting the sheep. In shearing with either hand or machine shears, care should be taken to keep each fleece whole. The best way for a beginner to learn to shear is to watch some one shear who knows how and learn by practice.

CARE OF THE WOOL

After the sheep has been shorn and removed, the fleece should be spread out on the shearing table with the flesh side down. All tags (dungy locks of wool) should be removed from the fleece, which should be folded into a tight bundle by folding towards the center. The wool should then be placed in a wool box and pressed and tied into a bale.

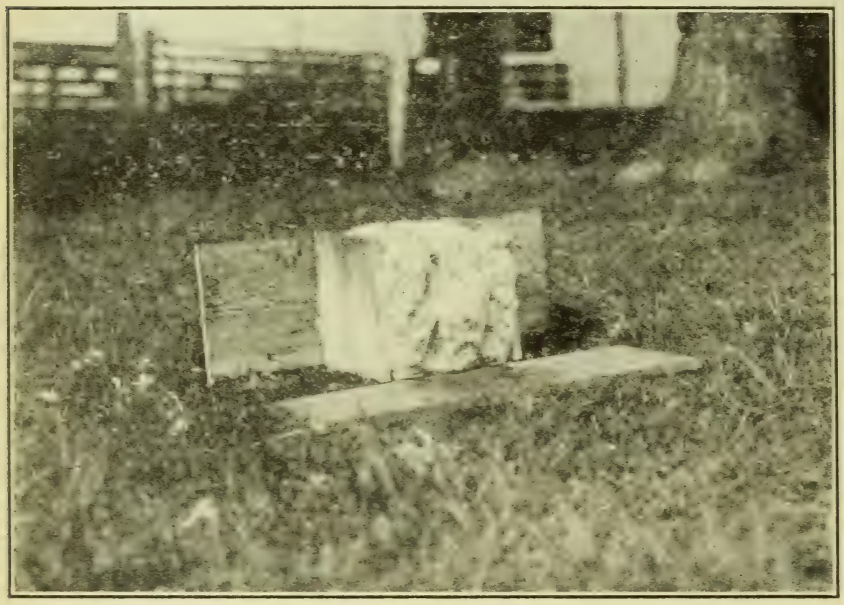


Fig. 11. Wool in the Box.

This wool box can be made from a piece of lumber 1 x 12 x 9. Saw from this nine-foot piece two three-foot pieces and three one-foot pieces. There are attached together with small hinges, as shown in figure 12.

This wool box is operated as follows: It is laid out flat with hinges up. The strings to tie the wool into a bundle should be cut in lengths slightly more than three feet. Use only a paper twine or a glazed surface twine. Do not use binder twine. Four strings are required for each fleece. One string should be across each opposite pair of hinges. The fleece is then placed on top of the strings and center board. All outside boards are then raised and the wool is packed into a compact bale. The two one-foot boards are held in position behind nails in the three-foot boards. The long boards are held together by wires. These wires should be placed so as not to interfere with tying. The wool is then packed down by hand and tied into a square bale, and is now ready to be packed for market.

There is a standard wool sack, holding approximately 200 pounds, for this purpose. These sacks can be purchased from various wool dealers and mills. A number of wool buyers advance these sacks to growers who ship their wool to them. In packing wool, all tags, burry fleeces, black fleeces, and fleeces from dead sheep should be packed separately from the rest of

the wool. If wool is to be stored, care should be taken to store in a clean, dry place.

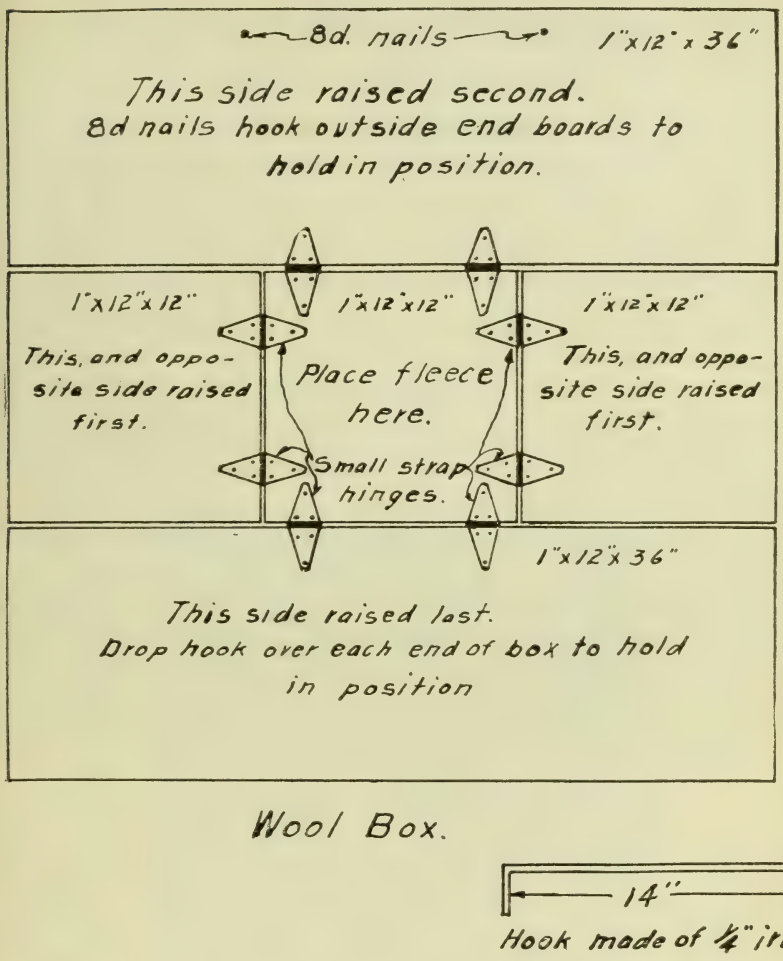


Fig. 12. A Plan for a Wool Box.
(Drawn by Agricultural Engineering Department)

MARKETING WOOL

There are three methods of selling wool in Mississippi. First, that of selling to local buyers; second, that of shipping to commission houses or wool buyers. and third, that of pooling and selling cooperatively. The third method is by far the best and has the following advantages:

1. Wool is gathered in large enough amounts to attract a number of large buyers, thereby securing real competition in the selling.

2. The selling can be placed in the hands of a competent man who studies the wool markets and sells when wool is highest.

3. Warehouses can be built where wool can be properly stored until sold.

4. Some pools are so organized that money can be borrowed on wool while in storage.

Individual producers and small pools must necessarily be sold to local buyers or wool houses. There are many reliable wool houses to which wool may be shipped and satisfactory prices received.

MARKETING LAMBS

There are three general methods of marketing. Each has its place in the marketing scheme, therefore a choice should not be made without careful investigation as to probable returns from each method.

An excellent way to market lambs from a small farm flock is to sell the dressed lamb to the special trade of restaurants and hotels. This trade requires a high grade product and naturally does not demand a very large number of lambs. When such a market is established, a very satisfactory price can be obtained.

Selling to local butchers and buyers, although a very general method, is probably the least profitable to the producer. These buyers must necessarily buy on a wide margin and the producer loses accordingly. This method of selling should be resorted to only in the event that it is impossible to employ one of the others.

The central market offers the best medium for a profitable disposal of the crop of the lamb club and large breeders.

The patron of the central market should establish relationship with a reliable commission firm and have them advise with him in regard to the market. Although on the average, the market is higher certain days in the week, it is well to get the advice of the commission firm as to when and how to ship. These men are on the market and are acquainted with it and are in a position to advise the shipper wisely. It is to their advantage and his to obtain the highest possible price.

SHIPPING LAMBS

Be sure that the car is ordered far enough ahead that it will be ready when the shipment is intended. The local freight agent can furnish information on this suggestion. In ordering, specify size of car needed. Approximately 160 eighty-pound lambs can be loaded in a single deck forty-foot stock car. Double deck cars may be obtained when ordered a sufficient time in advance for the company to locate one.

An estimate of the capacity of a car may be made on the basis of four eighty-pound lambs per running foot. The minimum weight for sheep in a forty-foot car is fourteen thousand pounds, and for a double deck car nineteen thousand pounds. These minimum weights should be loaded if possible.

The law requires that sheep in transit more than 28 hours must be unloaded, watered and fed. This time may be increased to 36 hours at the request of the shipper at time of billing.

The consignment may be made to any firm operating on the market to which the shipment is made. In every case, the commission firm should be notified of the probable arrival of the shipment and to whom the returns are to be made. The commission firm will receive the shipment, superin-

tend the feeding, handle the sale, pay all freight, yardage, and selling charges, and forward the net returns to you or your bank.

COOPERATIVE SHIPMENTS

As many owners can enter a cooperative shipment as desired. The animals of each owner must be marked so as to be easily identified. The usual method of marking is to use sheep paint and paint stripes over the shoulders, back or rump.

The shipment is made in the name of one individual, but the commission firm must be informed as to the ownership of the shipment. He should be furnished with the name of each owner, the number and sex consigned by each owner, and the mark of each owner. On arrival, the sheep are separated into lots according to mark and each owner's shipment is sold separately. The charges are figured on a pound basis, each shipper pays his pro rata, and individual returns are made.

Be sure that a special sheep paint is used. Ordinary paint will not scour out and sheep painted with it are docked in price. Sheep paint may be secured from any firm handling sheep supplies.

Fig. 13. Trimming Feet.

COMMON SHEEP AILMENTS

Sheep are very subject to colds and should be protected from drafts and cold rains. A strong, hardy sheep is more resistant to disease and parasitic infestation.

Sheep are easily excited and should at all times be handled carefully and in groups if possible. When it is necessary to handle sheep for treating and shearing, they should be confined as closely as possible so as to avoid running and any other undue excitement. When necessary to catch a sheep, either catch him under the chin and force his head up or grasp him in both hind flanks. Sheep are often caught by the hind leg. This is not a safe practice with heavy sheep, particularly with pregnant ewes well advanced in the pregnant stage. Never grasp a sheep by the fleece. This very often pulls the skin away from the flesh.

TRIMMING FEET

Sheep on soft soils often become lame or awkward in movement due to excessive growth of the toes. This may be prevented by trimming the toes with a sharp knife. This is a simple operation for one man when the sheep is caught and placed on his rump with his back to the operator. The excess toe is then trimmed from the under side, but care should be taken to avoid cutting into the "quick".

SCREW WORMS

This maggot is hatched from the egg from the common blow fly. The egg is laid in a wound. The treatment is by use of chloroform. The chloroform is poured into the wound and the dead worms should be removed with as little irritation to the wound as possible. After removal of the worms, pine tar may be used as a fly repellant.

GRUB IN THE HEAD

This is a parasite in the sinuses of the head, which worked its way up through the nasal passages after being deposited in the nostrils by a fly. This condition is very painful and a symptom of a heavy infestation is a bloody discharge. Another common symptom is a lowering of the head and rubbing of the nose on the ground or forelegs.

Treatment is of practically no avail. Prevention is practical and cheap. Pine tar smeared on the nose at regular intervals has proved to be quite satisfactory as a preventive measure. The tar may be used at the regular drenching period for stomach worms.

LICE

Lice are found on the skin of sheep and cause itching and irritation. Very often in heavy infestations, patches of wool may be rubbed off in scratching. The lice may be found on the skin by a close inspection.

Any of the standard dips used according to directions will rid the sheep of lice when the sheep are dipped twice with a fourteen-day interval. Lime-sulphur dip or Black-leaf 40 have given excellent results. After the first dipping, sheep should be removed to new quarters, unless they are on pasture.

STOMACH WORMS

Stomach worms are the most serious menace to the southern sheep industry. Rotation of pastures is a big factor in stomach worm control when it is possible to practice it. Even though a control measure, it is almost impossible to prevent infestation by this method. Pasture changes should be made as often as possible. Temporary pastures may be utilized to an advantage in rotation as plowing is an aid in stomach worm control.

The most effective treatment[1] at the present time is the bluestone (copper sulphate) treatment. The treatment should begin immediaely after the lambing period and continue until frost. The flock should be drenched every fourteen days with a 1% solution of copper sulphate. The 1% solution may be made by dissolving one ounce of bluestone in one pint of warm water. After these crystals have dissolved, add sufficient water to make three quarts. This amount will drench 24 mature sheep.

The dose recommended for sheep of different weights is given below:

Mature sheep	4 ounces
80-pounds lambs	3.5 ounces
70-pound lambs	3 ounces
60-pound lambs	2.5 ounces
50-pound lambs	2 ounces
40-pound lambs	1.5 ounces
30-pound lambs	1 ounce

Lambs weighing less than 30 pounds are not treated.

For tape worms, one ounce Black Leaf 40 (nicotine sulphate) should be added to every three quarts of the 1% bluestone solution, mentioned above at every other drenching. A glass measure graduated in ounces, a glass funnel, 3 feet of rubber tubing one-fourth inch in diameter, and a brass tube 8inches in length and one-eighth or one-quarter of an inch in diameter, and a glass or crockery (copper sulphate corrodes metal) mixing vessels is all the equipment necessary. Use blue crystals of copper sulphate and not the white.

The flock should be kept up the night before drenching without feed or water.

To drench, place sheep with its hind quarters against a fence or in a corner. The person to administer the dose stands to right of sheep, and with left hand, raises the sheep's head to a horizontal position, and with right hand ,inserts the brass tube in the space between the front and jaw teeth and on top of tongue. The accurate dose is measured in glass measure by the assistant and poured into the funnel which is attached to the brass tube by the rubber tube. Be sure that the sheep has swallowed before the head is lowered. In case of strangulation, the head should be lowered immediately.

OTHER INTERNAL PARASITES

Tape worms, nodular worms, and whip worms are common internal parasites of sheep in Mississippi. The treatment for tape worms is given

1. Treatment suggested by Dr. Cooper Curtice, Zoological Division, Bureau Animal Industry, McNeil, Miss.

above and the combined treatment for stomach worms and tape worms is usually effective against other intestinal parasites.

BLOATING

When sheep on dry feed are turned on green legumes, great care must be taken to prevent bloating. This is particularly true in grazing alfalfa and other clovers. More bloating occurs during wet weather or after heavy dews in the spring. It is advisable to give the sheep as much hay as they will clean up at the morning feeding, and then wait until the dew has dried off the forage before turning the flock to pasture.

CONSTIPATION

Constipation often occurs in mature sheep that are being fed coarse roughages in a dry lot. To prevent constipation, laxative feed, such as wheat bran, should be provided, or better still, a winter pasture. In severe cases of constipation, drench mature sheep with 2-4 ounces of Epsom salts. Lambs may be given 1 to 2 ounces of castor oil and a warm water enema.

A dose of castor oil is often sufficient to remove the irritation cause of diarrhoea in lambs.

CATARRH AND PNEUMONIA

Catarrh, commonly known as a "cold," is a result of exposure to dampness or cold, especially after early shearing. There is a discharge from the eyes and nose which is at first watery and later thick and stringy. Further symptoms are labored breathing, slight fever, lack of appetite, sneezing and coughing. Catarrh may followed by bronchitis or by pneumonia as a complication.

Catarrh is treated by smearing pine tar over the nostrils and providing clean, dry quarters.

Pneumonia, or inflammation of the lungs, may result from the same cause as catarrh, it may be due to localization of a general infection in the lungs, or it may be caused by carelessness in drenching or dipping when fluids are allowed to run down the windpipe.

The same general suggestions for the treatment of catarrh apply here; otherwise, treatment must be governed by the symptoms that appear.

SORE EYES

When sore eyes appear, either from injury or infection, drop 2 or 3 drops of 12% Argyrol solution in each eye daily until the inflammation subsides.

FOOT ROT

Foot rot may develop among sheep pastured or fed on wet ground. There is a severe lameness, discharge of pus from the hoof, and a bad odor about the feet.

To treat, change the flock to dry soil, clean affected feet, trim out diseased tissue, wash wounds with an antiseptic solution and dress with tar. Iodine may be used on affected parts of the foot.

PART II

SHEEP INVESTIGATIONS, MISSISSIPPI EXPERIMENT STATION, 1916-1928

This report summarizes the results of Sheep Investigations at the Mississippi Experiment Station since June 1, 1916. The results were obtained under the direction of the following:

H. K. Gayle, Station Animal Husbandman, 1916-19.

D. J. Griswold, Station Animal Husbandman, 1919-21.

E. Barnett, Head of Animal Husbandry Department, 1921-23.

G. S. Templeton, Head of Animal Husbandry Department, 1923-28.

H. H. Leveck, Assistant in Animal Husbandry, has been in charge of sheep investigations since 1926.

Grading Up With Purebred Mutton Rams

PLAN

In the spring of 1916, the Mississippi Station planned an experiment with the object in view of studying the possibilities of developing a grade ewe flock by the use of purebred rams on native Mississippi ewes. Particular attention was to be paid to the increase in wool production and the development of a ewe flock capable of producing a lamb to suit the demands of the early lamb market in regard to type, finish and early maturity, and at the same time, retain the hardiness, milking qualities, and early yeaning habits of native ewes.

With this in view, seventy-seven two and three-year-old native ewes were purchased in South Mississippi at a cost of three dollars per head on the car. These ewes were shipped from Picayune, Mississippi, on June 2 and seventy-five of them averaged 51.1 pounds in weight on June 22, 1916.

These ewes were divided into three lots and a purebred Southdown ram was run with one lot, a purebred Shropshire ram with one lot, and a purebred Dorset ram with the remaining lot.

Two ewes died during 1916 due to a heavy infestation of internal parasites.

1917 RECORDS

A seventy-five per cent lamb crop was raised to June, 1917. The best ewe lambs from this crop were added to the flock while the remainder were sold locally.

The records of the wool clipped and the yeaning dates are not available. Five ewes died during the year, leaving sixty-eight of the original native ewes in the flock. These native ewes were divided into four approximately equal lots. Three of the lots were the same as for 1916, and a purebred Merino ram was purchased for the additional lot.

1918 RECORDS

The sixty-eight native ewes yeaned sixty-five living lambs for a season's percentage of ninety-five. The birth dates for three of the lambs

were not recorded. Of the total number yeaned, 3 per cent came in December, 30 per cent in January, and 60 per cent in February.

The following table gives the birth weight by breeds of the lambs yeaned in the spring of 1918:

TABLE I

Birth Weight of 1918 Lambs from Native Ewes

Breeding of Sire—	No. of Lambs	Weight at Birth (Lbs.)
Southdown	15	6.8
Shropshire	16	7.3
Dorset Horn	16	7.1
Merino	15	6.4

The best ewe lambs were added to the flock and the remainder were sold in July for a price of $8.60 per head.

Three of the native ewes died during the year and the remaining sixty-five were divided into four lots and run as the year before. The grade yearling ewes were run with the rams of like breeding.

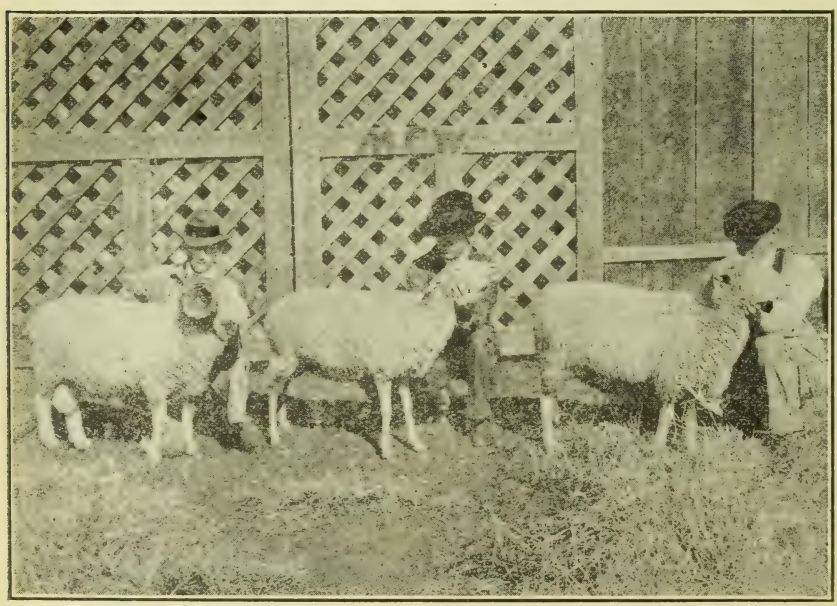


Fig. 14. A Purebred Dorset Horn Ram.—A Native Ewe and Their Grade Lamb.

1919 RECORDS

Including the yearling grade ewes, the flock for the yeaning season of 1919 numbered 87 head. These ewes produced an eighty-eight per cent lamb crop during this season. Eleven and five-tenths per cent came in December, sixty-eight and eight-tenths per cent in January, ten and four-tenths per cent in February, five and two-tenths per cent in March, and the remainder in April.

The following table gives the birth weight by breeds for the lambs yeaned:

TABLE II

Birth Weight of 1919 Lambs From Native and Grade Ewes

Breeding of Sire—	Breeding of Dam—	No. of Lambs	Wt. at Birth (Lbs.)
Southdown	Native	13	8.04
Shropshire	Native	14	9.32
Dorset Horn	Native	15	7.97
Merino	Native	14	8.39
Southdown	Southdown-Native	7	6.88
Shropshire	Shropshire-Native	6	7.83
Dorset Horn	Dorset Horn-Native	10	7.90

It will be noted that lambs from the native ewes were larger than those from grade ewes. This is probably due to the fact that all of the native ewes were mature while the grades were yearlings.

Sixty-two of these lambs were sent to St. Louis in a cooperative shipment. They sold on the market on June 17 for 14 cents per pound and their average weight was 51.61 pounds. The cost of selling was 82 cents per lamb, leaving $6.41 net per lamb.

Shearing data was secured in 1919 and is reported in the following table:

TABLE III

Average Weight of Native and Grade Ewes and Average Weight of Fleece Produced—1919

Number Ewes	Breeding of Ewes	Age	Avg. Wt. of Ewes Before Shearing (Lbs.)	Avg. Wt. of Fleece (Lbs.)
60	Native	Aged	65.2	2.52
18	Grade Southdown	1 and 2's	80.3	5.18
12	Grade Shropshire	1 and 2's	74.7	5.23
16	Grade Dorsets	1 and 2's	83.3	4.64
12	Grade Merinos	1 year	81.5	6.90

The average weight of fleece of the grade ewes is practically double that of the natives. This table further reveals that the grade ewes from the native ewes weigh 20 to 25 per cent more. A comparison of the weight of the native ewes on this date with their weight on June 22, 1916, reveals the fact that they have increased in weight from 52.1 to 65.2, a gain of 13 pounds due probably to a higher plane of nutrition.

Two ewes died during the year and all of the remaining native ewes except eight were sold. Twenty-five of the best native ewes were sold to the Coastal Plain Experiment Station at McNeil, Mississippi.

The breeding flock for the year consisted of the eight native ewes, fifteen grade Dorset ewes, eleven grade Shropshire ewes, seventeen grade Southdown ewes, and eleven grade Merino ewes.

1920 RECORDS

Only a 77 per cent lamb crop was raised for the year 1920. The earliness of yeaning was satisfactory, as 55 per cent came in January, 43 per cent in February, and the remainder in March.

TABLE IV

Birth Weight of 1920 Lambs From Native and Grade Ewes

Breeding of Ewe—	No. of Lambs	Weight at Birth (Lbs.)
Native	7	7.35
Grade Southdown	17	5.07
Grade Shropshire	12	5.29
Grade Dorsets	13	6.25
Grade Merinos	7	5.53

Fifty-one of these lambs were sold on the St. Louis market July 1. Thirty were classed as good lambs and sold for $13.00 per cwt., and averaged 61.3 pounds. Twenty-one were sold as culls for a price of $6.00 per cwt., and averaged 52 pounds in weight.

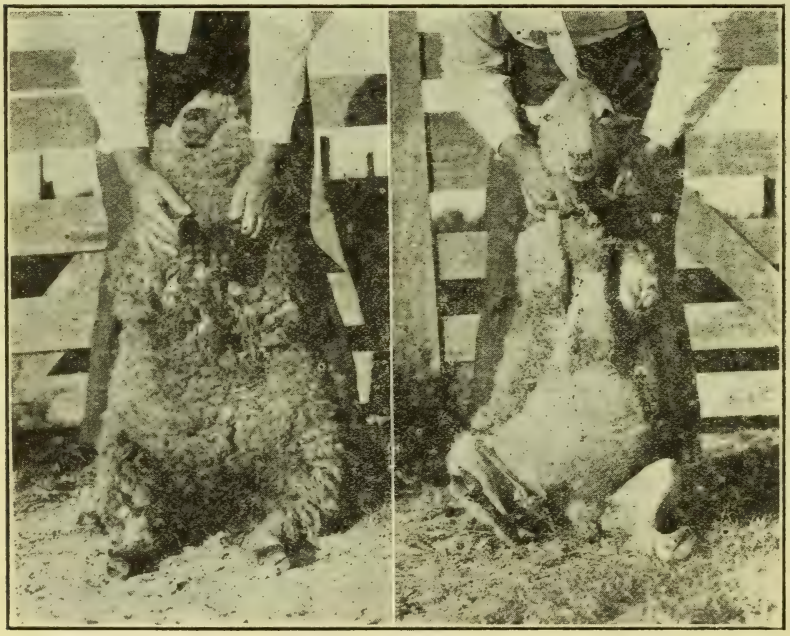


Fig. 15. Lamb from the native ewe on right sired by a purebred ram. Note the difference in wool covering.
(Coastal Plains Experiment Station, McNeil, Miss.)

The flock was sheared on May 5, 1920, and the following table gives the average weight of ewe before shearing and the average weight of fleece:

TABLE V

Average Weight of Native and Grade Ewes and Average Weight of Fleece Produced—1920

Number Ewes	Breeding of Ewes	Avg. Wt. of Ewes Before Shearing (Lbs.)	Avg. Wt. of Fleece (Lbs.)
8	Native	74.67	3¼34
17	Grade Southdown	76.41	4.57
15	Grade Shropshire	78.26	4.45
15	Grade Dorsets	89.53	4.43
11	Grade Merinos	73.63	5.65

No records of the flock were kept during the years of 1921, 1922, 1923, and 1924. The grade ewes were kept as a basic flock and Southdown rams were used. In the summer of 1925, forty-six local ewes of mixed breeding were purchased and added to the flock of forty-four grade ewes and sixteen grade ewe lambs. New work was planned and carried out as outlined in the following pages.

WINTERING BREEDING EWES, 1925-26

On December 10, 1925, ninety ewes were placed on a ration of one-fourth pound of cottonseed meal, and one and three-tenths pound of Johnson grass hay. At the end of the first week the amount of meal was raised to one-third of a pound and at the end of the second week, to one-half pound. Temporary pasture was available after the ewes yeaned. The following table gives the results of the work.

TABLE VI

Winter Breeding Ewes—First Trial

Breeding of Ewes—Grade Southdown, Shropshire, Dorset and Native Ewes
Age of Ewes—Two-Year-Old to Aged Ewes

Length of Period—December 10, 1925 to March 18, 1926—94 Days

Number of Ewes	90
Average Intial Weight (lbs.)	98.7
Average Final Weight (lbs.)	105.8
Average Gain per Ewe (lbs.)	7.1
Average Daily Gain (lbs.)	.075
Average Daily Ration:	
Cottonseed Meal (lbs.)	.489
Johnson Grass Hay (lbs.)	1.33
*Cost of Feed per Ewe	$ 1.54

*Cottonseed meal at $33.00 per ton and Johnson Grass Hay at $12.00 per ton.

The flock produced a 118 per cent lamb crop for the season of 1925 and 1926. The lambing season was late as only 37 per cent were yeaned prior to March 18, which was the end of the winter feeding period. As most of the ewes had not yeaned, it is indicated that this ration would

suffice for pregnant ewes, but would not suffice for suckling ewes, as is indicated by a subsequent experiment reported.

Fig. 16. Grade Lambs. First, Second, and Third Crosses.

WINTERING BREEDING EWES, 1926-27

The ewes were thin at the beginning of the 1926-27 winter feeding period. Wheat bran was added to the cottonseed meal-Johnson grass hay ration. Each ewe had green grazing immediately after yeaning.

TABLE VII

Winter Breeding Ewes—Second Trial

Breeding of Ewes—Grade Southdown, Shropshire, Dorset and Native Ewes
Age of Ewes—Two-year-Old to Aged Ewes

Length of Period—December 14, 1926 to February 9, 1927—58 Days

Number of Ewes	95
Average Initial Weight (lbs.)	100
Average Final Weight (lbs.)	100.4
Average Gain per Ewe (lbs.)	.4
Average Daily Gain per Ewe (lbs.)	.007
Average Daily Ration:	
Cottonseed Meal (lbs.)	.78
Wheat Bran (lbs.)	.39
Johnson Grass Hay (lbs.)	1.03
*Cost of Feed per Ewe	$1.13

*Cottonseed meal at $25.00 per ton, Wheat bran at $30.00 per ton, and Johnson grass hay at $12.00 per ton.

The ewes used in this work yeaned an 89 per cent lamb crop for the season. Seventy-seven per cent were yeaned prior to the end of the feeding period. As each ewe was turned to oat and rye pastures as soon as she yeaned, it would seem that this ration, along with a temporary grazing crop is an economical ration for wintering the breeding flock.

WINTERING BREEDING EWES, 1927-28

For the season of 1927-28, the flock was divided into three lots of 25 ewes each. Each lot received equal amounts of cottonseed meal and wheat bran. Corn was added to all lots January 8. Lot I received alfalfa hay, Lot II, Johnson grass hay, and Lot III, soybean hay in addition to grain. No pasture was available during this experiment.

TABLE VIII

Wintering Breeding Ewes—Third Trial
Breeding of Ewes—Grade Southdown, Shropshire and Native Ewes
Age of Ewes—Two-Year-Old to Aged Ewes

Length of Period—December 15, 1927 to March 2, 1928—79 Days

	Lot I	Lot II*	Lot III
Number of Ewes	25	25	25
Average Initial Weight (lbs.)	108	108	108
Average Final Weight (lbs.)	96	.....	98
Average Gain per Ewe (lbs.)	—12	.....	—10
Average Daily Gain per Ewe (lbs.)	—.151	.....	—.126
Average Daily Ration:			
**Corn (lbs.)	.28	.28	.28
Cottonseed Meal (lbs.)	.44	.44	.44
Wheat Bran (lbs.)	.28	.28	.28
Alfalfa Hay (lbs.)	1.07	.....	.....
Johnson Grass Hay (lbs.)	....	1.38	.....
Soybean Hay (lbs.)	....	.....	1.28
***Cost of Feed per Ewe	$2.42	.....	$2.28

*The Ewes in Lot II did not do well on the ration, so the lot was discontinued after 51 days of feeding, which would indicate that even though this ration was found to be satisfactory for pregnant ewes, it plus corn would not suffice for suckling ewes.

**Equal amount of corn were added on January 8 to all lots because ewes were losing weight.

***Corn was charged at $1.00 per bushel.
Cottonseed meal at $40.00 per ton.
Wheat bran at $38.00 per ton.
Alfalfa hay at $20.00 per ton.
Johnson grass hay at $12.00 per ton.
Soybean hay at $13.00 per ton.

As stated, Lot II was discontinued after 51 days of feeding due to the fact that the ewes were unable to produce the milk required on such a ration. As 89 per cent of a 101 per cent lamb crop was yeaned during the feeding period, practically all ewes were suckling lambs for a greater part of the period. It will be remembered that this ration without corn was a satisfactory ration for breeding ewes prior to lambing in the first trial.

There was no noticeable difference in the condition of the ewes nor in lambs produced between the lots on alfalfa and soybean hay. The cost of wintering was slightly in favor of the soybean lot for the prices used.

STOMACH WORM CONTROL WORK

This station for the past three years has tried various methods for controlling stomach worms. A brief report of this work is given below:

During the grazing season of 1926, the flock of mature sheep and the lambs were drenched every four weeks with Lugol's solution. Some forty per cent of the lambs were lost during the season with typical symptoms of heavy stomach worm infestation. Post-mortem examinations showed a heavy stomach worm infestation and a few tape worms. A few of the older ewes developed symptoms during the latter part of the grazing season. One was posted and showed heavy stomach worm infestation.

During the grazing season of 1927, the flock of mature sheep and the lambs were drenched every three weeks with a 1% solution of copper sulphate. *Forty lambs were posted in June by competent parasitologists and showed from medium to heavy infestation of stomach worms and tape worms. Of thirty lambs carried through the entire grazing season, five died and upon being posted, showed heavy infestation of stomach worms and a few tape worms. A few ewes developed symptoms of stomach worm infestation, but none were posted.

Since the season of 1928, the method as recommended in this bulletin has been employed with good success. The breeding flock has been kept in a strong, healthy condition and of fifty-one lambs treated and slaughtered, fifty-eight per cent were found to be entirely free of stomach worm infestation. The report on these lambs as made by parasitologists of the Zoological Division of the Bureau of Animal Industry, Washington, D. C., follows:

TABLE IX

Intestinal Worm Report of Lambs

	Stomach Worms	Whip Worms	Nodular Worms
Number of lambs examined	51	51	51
Number of lambs free of worms	30	30	46
Number of lambs with very light infestation	2	1	0
Number of lambs with light infestation	19	13	5
Number of lambs with moderate infestation	0	7	0

Twenty-six of the fifty-one lambs were free of tape worms. Nine contained one tape worm and the remainder had two, three or four tape worms.

Not a single lamb was found to have a heavy infestation of any kind of internal parasite.

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* The forty lambs and the fifty-one lambs referred to are from a part of a national project "A Study of the Facts that Influence the Quailty and Palatability of Meat," conducted by the Mississippi A. & M. College and the Bureau of Animal Industry, United States Department of Agriculture cooperating.

SUMMARY

Native ewes are hardy, thrifty, good milkers, and will breed early.

The grade ewes produced by crossing purebred rams on native ewes inherit the early breeding habit of the dam.

Desirable market lambs can be produced from grade and native flocks by the use of purebred rams.

Purebred rams will sire lambs that will, when mature, produce twice as much wool as their native dams.

Pregnant ewes may be carried up until lambing time on grass hay and a small amount of cottonseed meal.

Suckling ewes require more feed than pregnant ewes and should be fed accordingly.

Temporary pastures for winter grazing are inestimable in value.

Late lambs and lambs on light pasture should receive a grain ration in order that they may be put on the high market. (Lamb prices are usually highest in May and early June).

Stomach worms and other internal parasites can be largely controlled by proper drenching.

HELPFUL REFERENCES

Most of these publications can be obtained free by request from the institution concerned.

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Farmers' Bulletin No. 840 (1925): Farm Sheep Raising for Beginners.

Farmers' Bulletin No. 996 (1924): Flushing and Other Means of Increasing Lamb Yields.

Farmers' Bulletin No. 1155 (1927): Diseases of Sheep.

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University of Kentucky, Lexington, Kentucky:

Circular No. 79 (1920): A Suggested Plan for Marketing Kentucky Wool.

Circular No. 85 (1924): Docking and Castrating Lambs.

Circular No. 151 (1923): Care and Management of Ewe and Lamb.

Circular No. 153 (1923): Purebred Rams are Profitable.

SHEEP PRODUCTION
IN MISSISSIPPI

BY
H. H. LEVECK & D. S. BUCHANAN

Bulletin No. 261 November, 1928.

Progress Report of

INVESTIGATIONS ON DISEASES OF VEGETABLE AND ORNAMENTAL PLANTS

By

H. H. Wedgworth, Associate Plant Pathologist
State Plant Board

Tomato Wilt

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
J. R. Ricks, Director.

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Progress Report of

Investigations on Diseases of Vegetable and Ornamental Plants

—By—

H. H. Wedgworth, Associate Plant Pathologist

State Plant Board

The purpose of this paper is to report the progress of the investigations on vegetable and ornamental plant diseases carried on by the Department of Plant Pathology of the Mississippi Agricultural Experiment Station and the Mississippi State Plant Board. More detailed results of some of the 1928 experiments mentioned herein have been published previously in bulletin or circular form by this Station.

TOMATO WILT AND BLOSSOM-END ROT STUDIES

The studies on tomato wilt and blossom-end rot in 1928 were conducted along the same general plans as those in 1927. In 1928, nineteen varieties of tomatoes were planted on soil heavily infested with the wilt organism, *Fusarium lycopersici*, and also on wilt-free soil.

The seed of the various varieties used in these tests were sown in greenhouse flats on February 20. The plants were transplanted to cold frames on March 15 and to the field on April 26. The soil in the field was of a light sandy loam type and had received a uniform application of about 1200 pounds of an 8-4-4 (P-N-K) fertilizer per acre in the drill about two weeks before the plants were transplanted to the field. The wilt-infested soil used in 1927 was used again for the wilt-infested soil test in 1928. In addition to the fungous inoculum already present in the soil, a mixture of about twenty-five grams of sand and a pure culture of the wilt fungus which had been grown for about five weeks on a culture medium made of one part of cornmeal and two parts of sand, was placed in each hill as the plants were being transplanted. The test on the wilt-free soil was conducted in a field that had never been planted to tomatoes before and no wilt symptoms were apparent on any of the plants at any time during the season. The plants in both tests were set twenty-eight inches apart in rows three and one-half feet wide and fifty feet long. Four series, arranged in such a way as to overcome soil variations, were planted in each test. The plants were staked

and pruned to one main stem until about the middle of July at which time they were topped.

Apparent wilt readings were made at intervals of about three weeks during the growing season. The fruits were harvested as soon as ripe, sorted into marketable and culls, and weighed in the field. The cull fruits from the wilt-free test were also sorted into various classes depending upon the cause of the cull; namely, blossom-end rot, cat-faces, puffs, etc. The summarized results from these tests are given in tables 1 and 2.

TABLE 1

Test for Wilt Resistance of 19 Varieties of Tomatoes in 1928*

Name of Variety	Apparent wilt in percentage				Rank in resistance	Pounds of marketable fruit per acre
	June 2	June 21	July 16	Aug. 4		
La. Red	0.0	1.2	10.7	22.6	2	7,925
La. Pink	1.2	2.4	11.9	23.8	3	7,431
Norton	3.6	3.6	13.1	23.8	4	5,823
Marvana	2.4	14.3	19.0	27.4	5	5,475
Globe "L"	4.8	13.1	27.4	77.4	8	5,132
Globe "R"	3.6	14.3	31.0	83.3	11	4,983
Globe "SS"	7.1	13.1	28.6	81.0	9	4,830
Marvel	1.2	3.6	9.5	17.9	1	4,806
Kanora	4.8	14.3	17.9	45.2	6	4,475
Globe (Liv.)	8.3	20.2	35.7	86.9	12	4,350
Perfection	15.5	35.7	52.4	88.1	14	4,197
Marglobe	3.5	17.5	35.3	75.2	10	4,069
Gulf States	20.2	56.0	70.2	94.0	16	3,864
Richard's	11.9	29.8	48.8	84.5	13	3,640
Marvelosa	1.2	4.8	22.6	57.1	7	3,344
Bryan's	8.3	41.7	67.9	90.5	15	2,684
Crystal S. Mkt.	51.2	92.9	95.2	97.6	17	1,311
Stone	66.7	95.2	97.6	98.8	19	802
Detroit	50.0	92.9	96.4	100.0	18	646

*Average of 4 plats.

The results given in table 1 again demonstrate that there is a marked difference in the susceptibility of various varieties of tomatoes to Fusarium wilt. Due to the fact that resistance to wilt is coming to be the most important prerequisite for a successful tomato variety for Mississippi conditions, too much stress cannot be put upon selecting a good resistant variety best suited to a given locality. During the past two years, the Louisiana Red and the Louisiana Pink have ranked near the top in resistance to wilt and in yield of fruits. The Marglobe during 1924, 1925,

and 1927 was a very outstanding variety but in 1928 it was quite susceptible to wilt and was not as productive as in former years. No explanation can be given for its poor behavior during 1928. It is still to be considered, however, as one of the leading wilt-resistant varieties of tomatoes. The Marvana is an outstanding, early, wilt-resistant variety of the Earliana type. The Norton continues to be a good, medium late-season, resistant variety. The

TABLE 2

Comparison of the Yields of Wilt-Resistant and Non-Resistant Varieties of Tomatoes on Wilt-Free Soil and Notes on Other Varietal Characteristics During 1928*

Name of variety	Character of fruit			% blossom-end rot	% cat-faces	% puffs	Total % culls	Pounds of marketable fruit per acre
	Color	Av. Wt. in pounds	Order of ripening					
Kanora	Red	.245	12	3.8	3.4	2.5	40.1	8,306
Marvana	Red	.224	1	5.8	6.0	0.4	47.3	7,913
Gulf States	Pink	.292	5	2.5	8.0	5.2	52.0	6,714
Detroit	Pink	.330	9	5.4	8.8	4.6	49.0	6,524
Richard's	Pink	.322	17	3.0	8.7	5.9	56.7	6,509
La. Red	Red	.232	16	9.5	4.1	6.9	59.1	6,334
La. Pink	Pink	.247	10	9.1	3.6	6.5	60.1	6,252
Perfection	Red	.279	8	5.4	16.3	1.3	54.9	5,924
Stone	Red	.329	15	9.2	13.6	1.3	52.2	5,903
Marglobe	Red	.312	6	4.3	9.1	3.7	47.1	5,823
Marvel	Red	.257	3	10.8	10.3	0.6	51.7	5,704
Marvelosa	Pink	.272	4	15.8	12.7	0.5	54.5	5,285
Norton	Red	.323	13	2.0	11.7	1.9	54.8	5,206
Globe "SS"	Pink	.323	18	5.6	5.2	5.2	67.5	5,133
Crystal S. Mkt	Pink	.252	11	17.8	5.4	2.1	54.9	5,062
Globe (Liv.)	Pink	.308	19	9.9	6.0	3.8	63.5	4,769
Globe "R"	Pink	.308	14	6.7	5.0	4.2	67.1	4,578
Globe "L"	Pink	.298	7	7.2	5.7	4.1	65.3	4,559
Bryan's	Pink	.284	2	5.7	6.7	4.3	68.1	4,064

*Average of 4 plats.

Marvel is one of the most resistant varieties but is not quite as productive as some of the other varieties. The various selections of the Globe variety were furnished by Lotterhos & Huber of Crystal Springs, Mississippi, for these tests. The differences in the yield and resistance to wilt of these selections are so small that they may be due to experimental error. Some of the varieties used in these tests have been advertised by various seedsmen as wilt-resistant but have proved to be very susceptible to wilt under the conditions of these experiments.

The data presented in table 2 show that some of the better wilt-resistant varieties are as productive even on wilt-free soil as some of the best commercial non-resistant varieties. The data given in this table also show that there is a marked difference in the susceptibility of the various varieties to blossom-end rot and cat-faces.

A detailed discussion of wilt and blossom-end rot of the tomato together with the results of experiments conducted during previous years on these diseases is given in Mississippi Agr. Exp. Sta. Bul. 247.

IRISH POTATO SEED TREATMENT EXPERIMENTS

In 1927 and 1928, experiments were conducted to compare the effect of various organic mercury disinfectants with that of bichloride of mercury for the control of the common scab of the Irish potato caused by *Actinomyces scabies.* The plans of the experiments for the two years were practically the same. Slightly scabby potato seed of the Triumph variety were divided into lots of equal weight and number. The various lots were then treated according to the outlines given in tables 3 and 4. In 1927, the treatments were made on February 25 and the seed planted February 26. In 1928, the treatments were made on March 19 and the seed planted on March 22. The potatoes were planted one foot apart in rows three feet wide and twenty-five feet long. At harvest the potatoes were sorted into various classes depending upon the amount of scab present, namely; clean (free of all scab lesions), marketable scabby (slightly scabby tubers to those with about ¼ of the surface scabby), and unmarketable scabby

TABLE 3

Relative Value of Various Seed Potato Disinfectants for the Control of Scab in 1927.

Treatment	Time of treatment	Per cent clean	Per cent scabby	Bushels per acre	
				Marketable sized tubers	Culls
Bichloride of mercury 1-1000	30 min.	99.4	0.6	63.4	7.1
Bichloride of mercury 1-1000	1 hour	99.2	0.8	58.1	6.4
Bichloride of mercury 1-1000	1½ hrs.	99.7	0.3	57.8	3.9
Dipdust 1-20	Dipped after cut	98.2	1.8	69.5	6.2
Semesan Bel 1-20	Dipped after cut	95.7	4.3	67.0	8.1
Untreated	———	89.0	11.0	65.0	6.4

(tubers with more than ¼ of the surface covered by scab lesions). Weights were taken on the marketable and unmarketable sized tubers regardless of the amount of scab present. The data from these experiments are given in tables 3 and 4. The

TABLE 4

Relative Value of Various Seed Potato Disinfectants for the Control of Scab in 1928.

Treatment	Time of treatment	Per cent clean	Per cent scabby		Bushels per acre	
			Marketable	Unmarketable	M'ktable sized tubers	Culls
$HgCl_2$ 1-1000	30 min.	94.6	4.8	0.6	62.2	15.4
$HgCl_2$ 1-1000	1 hour	92.0	8.0	0.0	58.7	10.4
$HgCl_2$ 1-1000	1½ hrs.	92.6	6.9	0.5	49.2	7.6
Semesan Bel 1-20	Dipped after cut	85.2	11.2	3.6	57.0	9.8
Dipdust 1-20	Dipped before cut	89.8	7.3	2.9	67.5	10.2
Dipdust 1-20	Dipped after cut	90.3	8.0	1.7	72.7	12.7
Untreated	———	57.9	22.5	19.6	61.0	16.2

results from the Irish potato seed treatment experiments conducted during 1927 and 1928 indicate that the organic mercury disinfectants are not superior to bichloride of mercury for the control of common scab. These disinfectants did not have any noticeable effect upon germination or upon the total yield of potatoes. By varying the length of time of soaking the potatoes in a 1-1000 solution of bichloride of mercury, it has been shown that a thirty minute treatment is about as effective as treating for longer periods for the control of scab.

IRISH POTATO DUSTING AND SPRAYING EXPERIMENT

The Irish potato dusting and spraying experiment for 1928 was conducted on a very uniform, sandy loam soil. Triumph potato seed were planted March 3 but germination was delayed by the cold, wet weather during March and the early part of April. The experimental field was divided into plats consisting of four rows, each three feet wide and thirty-one feet long. The potatoes were up to almost perfect stand by April 5 but the frequent rains prevented making the first application of fungicides until April 18. Additional applications were made on April 28 and May 7. The fungicides used were a 4-4-50 Bordeaux mixture, eleven pounds of colloidal copper (furnished by the Crop Protection Institute) in fifty gallons of water, and a 20-80 copper-lime dust (furnished by the Niagara Sprayer Company). The sprays were applied with a compressed air spray pump using as

much pressure as could be obtained. The dust was applied with a Root hand gun commonly used for dusting cotton.

A small amount of early blight developed on the potatoes in the latter part of the season but there was not enough to compare the effect of the different fungicides on the control of this disease. During the latter part of the season, tip-burn became quite severe on the untreated plats and also on the plats sprayed with colloidal copper. There were a few leaf hoppers present but apparently not enough to account for all the burning of the leaves. The average yields for the different treatments are given in table 5.

TABLE 5

Effect of Dusting and Spraying Upon Potato Yields. 1928.

Treatment	Bushels per acre		Increase or decrease of marketable potatoes over check
	Marketable	Culls	
Check	165.3	20.5	
4-4-50 Bordeaux mixture	179.1	23.7	+13.8
11-50 Colloidal copper	164.2	21.9	—1.4
20-80 Copper lime dust	168.1	23.5	+2.8

The results given in table 5 indicate that Bordeaux mixture decreases the amount of tip-burn and increases the yield of potatoes. Probably a larger number of applications of the fungicides would have given better results. This problem is one that is badly in need of additional study in the Southern States.

CERTIFIED IRISH POTATO SEED TESTS

In 1928, the certified Irish potato seed studies which had been conducted during former years were continued at the Main Experiment Station, the South Mississippi Branch Experiment Station, and the Raymond Branch Experiment Station in cooperation with the Mississippi State Plant Board. The results during 1928 again show that certified seed, as a rule, have much less mosaic, spindle-tuber, and leaf-roll than uncertified seed and produce greater yields. During the past four years, certified potato seed of the Triumph variety averaged 42.8 per cent more marketable potatoes than uncertified seed. Many samples of uncertified seed produced only about one-half the yield of the better samples of certified seed. The results of the 1928 tests have been summarized in Mississippi Agr. Exp. Sta. Cir. 80.

EFFECT OF DEGENERATION DISEASES OF THE IRISH POTATO UPON YIELDS

The results from the studies on the effect of the degeneration diseases on the yields of the Irish potato during 1927 and 1928 have been published in Mississippi Agr. Exp. Sta. Bul. 258.

SWEET POTATO SEED TREATMENT EXPERIMENTS

In the spring of 1927, experiments were inaugurated to test various disinfectants for the control of black-rot, a fungous disease caused by *Ceratostomella (Sphaeronema) fimbriata.* The sweet potato seed used in 1927 were selected from a storage house that had a large per cent of the potatoes infected with black-rot. Only apparently disease-free seed were selected for this experiment. The same disinfectants used in 1928 and listed in table 6 were used in 1927. Since very little black-rot developed in the checks of this experiment, the data was of little or no value in showing the effect of the various disinfectants on the control of this disease. The potato plants from the various treatments were transplanted to the field in order to study the effect of the disinfectants on the yield of potatoes. Although the average yield of nine replications for each treatment varied slightly from the average of the untreated, the differences in each case were well within experimental error and no significance can be placed upon them.

In 1928, sweet potato seed of the Nancy Hall variety were selected from an apparently disease-free lot of potatoes for the seed treatment experiment. The potatoes were inoculated with the black-rot organism by dipping them into a heavy suspension of conidia, chlamydospores, ascospores, and fragments of mycelium. They were covered with a canvas and allowed to stand in a warm room for about six hours after which they were spread out to dry over night. The seed were divided into twenty-one lots of fifty potatoes each. Each lot of potatoes weighed 3840 grams. Three lots were treated with each disinfectant according to the outline given in table 6. Six lots were left untreated to be used as checks. The potatoes were then bedded in a mixture of sand and leaf-mold. The plants were pulled, counted, and weighed on June 4, June 28, and July 14. The results of this test are given in table 6.

The per cent of plants in this experiment infected with black-rot does not express the total value derived from treating the potatoes with the various disinfectants because the disease

was so severe in the check that only a few plants reached the surface of the soil. No injury was noted from any of the treatments except in the case of formalin for thirty minutes. The seed given this treatment were a little slow in germinating and fewer plants were produced than where formalin was used for ten minutes. The standard bichloride of mercury treatment

TABLE 6

Relative Value of Various Sweet Potato Seed Disinfectants for the Control of Black-Rot During 1928.

Treatment	Time of treatment	Per cent plants infected with black-rot	Average number plants per plat	Average weight per plant
Check	——	51.0	27.5	9.4
Bichloride of mercury 1-1000	10 min.	18.1	236.0	9.4
Dipdust 1-20	dipped	20.6	130.3	10.0
Semesan Bel 1-20	dipped	28.3	74.0	10.1
Formalin 3-400	10 min. washed	15.2	250.0	9.2
Formalin 3-400	30 min. washed	4.8	129.3	11.2

proved to be slightly superior to the Semesan Bel and the Dipdust treatments for the control of black-rot. Formalin seems to be the most promising of the disinfectants used but since it causes injury under some conditions, it will be necessary to study its behavior under varying conditions before definite recommendations can be made. The standard 1-1000 bichloride of mercury treatment for ten minutes seems to be the safest disinfectant at the present time for sweet potatoes.

OBSERVATIONS ON SWEET POTATO MOSAIC

During the summer of 1926, vine cuttings were made from twenty-three hills of sweet potatoes, which showed varying degrees of the mosiac disease, and were transplanted to the field. Five of these selections were used to study the effect of the disease upon the yield and to determine whether the severity of the disease increases from year to year after infection has taken place. Yield records have been taken from four tests conducted over a period of three years and are given in table 7. The first year's yields are of questionable significance because of the small

number of plants used. The results of these tests indicate that the mosaic disease varies in its effect on the yield of sweet potatoes under different conditions.

TABLE 7

Effect of the Mosaic Disease of the Sweet Potato upon the Yields.

Selection	Comparative yields of diseased & healthy plants in per cent			
	1926	1927	1928*	1928*
Healthy	100.0	100.0	100.0	100.0
M-1	71.4	65.7	65.0	56.3
M-2	23.3	——	49.5	58.7
M-6	24.7	57.8	58.0	49.5
M-7	37.5	57.4	59.6	49.5
M-14	25.5	38.6	65.5	58.1

*Two experiments were conducted during 1928.

Although most of the plants from a given line will show symptoms of mosaic similar to their parent plant, a few plants sometimes vary widely in this respect and in some cases the symptoms of mosaic disappear entirely and the plant apparently recovers from the attack of the disease. Whether such plants would show mosaic symptoms under the proper conditions has not been determined. In other cases, the symptoms of mosaic may become more evident. This variation has also been noted in individual plants. For example, during the summer of 1928 a vine about five feet long was noted in the greenhouse on which the leaves for about one foot next to the main stem showed severe symptoms. The leaves on the next thirteen or fourteen inches of the same vine were apparently devoid of mosaic symptoms while the leaves on the rest of the vine showed very severe symptoms of this disease. No explanation for this variation is known.

The transmission of sweet potato mosaic has been given some attention during the past two years. The results of these studies confirm the earlier work of Rosen and Weimer in that attempts at transmitting the disease by grafting and by transferring the sap of a diseased plant to a healthy one by mechanical means have been unsuccessful. Observations on potato fields which have been carefully rogued of mosaic-diseased plants for the past four or five years and which continue to show a small per cent of diseased plants indicate that the disease is transmitted in some way in North Mississippi where the growing period for sweet potatoes is not more than seven or eight months. These observations are not in accord with Rosen's conclusions to the effect that the inoculated healthy plant must have a continuous

growing period of twelve or thirteen months and that the disease "is not capable of being transmitted in healthy plants under natural conditions in the northern sweet potato sections, while in the southern-most regions, as around the Gulf of Mexico, there is ample opportunity for transmission." The question of how sweet potato mosaic is transmitted, if it is a true mosaic, is still unknown.

An interesting observation was made on the yields of roots of mosaic-diseased tops grafted onto healthy roots as compared to healthy tops grafted onto diseased roots. On June 27, 1928, seven plants were grafted according to the procedure mentioned above and transplanted to a bed in the greenhouse which had been filled with thoroughly mixed sandy loam soil. All of the plants were watered and cared for in practically the same manner.

TABLE 8

Yield of Enlarged Roots from Mosaic-Diseased Sweet Potato Tops Grafted on Apparently Healthy Roots and Vice Versa.

Treatment	Average weight of roots from 7 plants in grams	Comparative weight on percentage basis
Diseased tops/healthy roots	128.1	100.0
Healthy tops/diseased roots	74.6	58.2

The yields of potatoes which were taken November 1 are given in table 8. The yield of potatoes on the healthy roots and diseased tops was nearly twice as great as that for the diseased roots on the healthy tops. Although the number of plants used in this experiment is too small to permit any significant conclusions to be drawn, the results indicate that the mosaic disease of sweet potatoes has some other effect upon the yield than merely the destruction of chlorophyll in the leaves.

STUDIES ON CABBAGE YELLOWS

In the spring of 1928, studies on yellows-resistant cabbage varieties were inaugurated at this Station in cooperation with Dr. J. C. Walker of the University of Wisconsin.

In one experiment, six varieties of cabbage were planted to test their resistance to yellows and yielding ability under Mississippi conditions. Due to the fact that the inoculum of the yellows fungus *(Fusarium conglutinans)* was not available at transplanting time, no data was obtained on the resistance of the various varieties in this test. The yield records show, however,

that the Marion Market, All Head Select, Wisconsin All Seasons, and Wisconsin Brunswick are well suited for garden varieties under Mississippi conditions.

In the second experiment, several selections of the Jersey Wakefield variety made by Dr. Walker were tested. The seed were sown February 8 in greenhouse flats. The soil in the experimental field was of a light sandy loam type which had received an application of about 1200 pounds of an 8-4-4 (P-N-K) fertilizer per acre. The plants were transplanted to the field on March 26. They were set one foot apart in rows three feet wide and twenty-five feet long. Six series of plats were inoculated by placing a heaping teaspoonful of a mixture of sand and a pure culture of a strain of the yellows fungus, which had been isolated during the summer of 1927 from specimens collected near Houston, Mississippi, and which had been grown for thirty-two days on one part of cornmeal and two parts of sand, in each hill as the plants were being transplanted. Two series of plats were not inoculated. Readings were made on the number of plants infected with yellows at intervals during the growing season. The results of this experiment are given in tables 9 and 10.

TABLE 9

Results from Jersey Wakefield Cabbage Strain Test on Yellows-Sick Soil

Strain	% stand	% plants infected with yellows			% plants not harvested because of yellows	Av. weight per head	Tons per acre
		6-1	6-12	7-3			
Commercial	99.3	12.8	23.5	39.6	20.1	1.139	5.84
2027 B	98.7	0.7	0.7	0.7	0.0	1.143	8.13
Hg27 A	97.3	56.9	69.9	92.5	61.6	1.179	3.65
5HIA	97.3	17.1	26.0	35.6	20.6	1.101	5.33
G351 A	98.7	18.9	23.0	33.1	15.5	1.185	7.34
2027 A	98.7	6.1	11.5	13.5	4.1	1.113	7.49
All Head Select	96.9	1.4	2.1	4.8	0.7	.997	5.35

Selection 2027 B had been selected as being homozygous for resistance to yellows and Hg27 A as being homozygous for susceptibility to yellows. 2027 A was a heterozygous strain which was quite resistant to yellows and very similar in type to 2027 B. The other selections were crosses between resistant and suscep-

tible strains and were expected to segregate into a ratio of three resistant plants to one susceptible one.

TABLE 10
Results from Jersey Wakefield Cabbage Strain Test on Yellows-Free Soil. 1928.

	% heads harvested			Av. wt. per head	Tons per acre
	June 12	June 26	July 7		
Commercial	39.53	37.21	23.26	1.643	10.26
2027 B	98.00	2.00	0.0	1.396	10.13
Hg27 A	9.09	50.00	40.91	1.237	7.90
5HIA	32.56	51.16	16.28	1.247	7.78
G351 A	51.22	34.15	14.63	1.376	8.19
2027 A	89.80	8.16	2.04	1.333	9.49
All Head Select	26.67	46.66	26.67	1.312	8.57

The results given in table 9 show that the different strains developed the approximate amount of yellows which was expected. The selection 2027 B was very resistant to yellows. A study of this strain in table 10 shows that it is a very promising strain even on non-infested soil. Although the yield of this strain was approximately the same as that of the commercial strain on the non-infested soil, it has a decided advantage over the commercial strain in that all of the heads mature at about the same date, permitting most of the heads to be cut at the same cutting.

OBSERVATIONS ON BEAN BLIGHT AND BEAN MOSAIC

Samples of snap bean seed of the Burpee's stringless green pod variety were secured from various sources and planted in the field May 3, 1928, for the purpose of determining the relative amount of mosaic, and yielding ability of seed from various sources. The seed were planted in hills one foot apart in rows three feet wide and twenty-five feet long. Six replications were made. Four seed were planted per hill and a good stand was secured for each sample. Due to the fact that some of the samples were infected with bacterial blight, which is caused by *Bacterium phaseoli*, and that the weather conditions were unusually favorable for the development of this disease, it was necessary to make mosaic counts quite early in the season. Notes were taken on the relative amount of bacterial blight at the time of making the mosaic readings. A few days after the disease readings were made, blight spread over the entire field and only one picking, July 10, of green beans was made. The notes from these observations are tabulated in table 11.

It is interesting to note that the western-grown seed were relatively free of blight on June 12 but most of these samples contained quite a large per cent of the mosaic diesease. The results of this test are in accord with observations made in various parts of the State during the past two years on commercial

TABLE 11

Summarized Results from Source of Snap Bean Seed Test of the Burpee's Stringless Green Pod Variety. 1928.

Source of seed	State where grown	Relative amount of bacterial blight June 12	Per cent plants infected with mosaic June 12	Pounds of green beans per acre
Geo. Tait & Sons, Norfolk, Virginia.	Utah	trace	17.3	2220
United States Seed Co., St. Louis, Mo.	Idaho	none	14.9	2018
Associated Seed Growers, New Haven, Connecticut	Idaho	slight	11.1	1889
Rogers Bros. Seed Co., Chicago. Illinois	Idaho	trace	20.9	1774
H. G. Hastings Co., Atlanta, Georgia	Unknown	slight	11.4	1748
Vaughan's Seed Store, Chicago, Illinois	Michigan	none	8.0	1742
D. M. Ferry & Co., Detroit, Michigan	Michigan	severe	15.3	1687
Job P. Wyatt & Sons Co., Raleigh, N. Carolina	Unknown	trace	16.2	1601
Leonard Seed Co., Chicago, Illinois	Michigan	very severe	23.7	1549
W. Atlee Burpee Co., Philadelphia, Penn.	Idaho	slight	29.0	1527
Chris Reuter Seed Co., New Orleans, La.	Unknown	none	28.1	1409

*Average of 6 plats.

plantings of beans with seed from different sources.

Additional observations were made upon several varieties of beans for resistance to bacterial blight. The beans had been planted according to the same general plan as the source of seed test. The beans were picked July 10 and the total weights taken. The results are given in tables 12 and 13. The yield of beans as given in these tables may not represent the relative resistance to bacterial blight since the earlier varieties may have had a chance to produce some beans before the disease became so destructive. The ability of a variety of beans to produce a crop un-

der the conditions of these experiments is, however, of much value—at least in certain seasons.

TABLE 12

Yield of Several Varieties of Green-Podded Snap Beans Under an Epidemic of Bacterial Blight.*

Variety	Source of seed	Pounds per acre
Red Valentine	Asso. Seed Growers, Inc. New Haven, Connecticut.	2337
Bountiful	Asso. Seed Growers, Inc., New Haven, Connecticut.	1749
Burpee's Stringless	Wood, Stubbs Company, Louisville, Kentucky.	1497
Black Valentine	Asso. Seed Growers, Inc., New Haven, Connecticut.	1487
Giant Stringless	Asso. Seed Growers, Inc., New Haven, Connecticut.	1411
Fordhook Favorite	Job P. Wyatt & Sons Co., Raleigh, North Carolina.	1077
Tennesse Green-Pod	Wood, Stubbs Company, Louisville, Kentucky.	843
Full Measure	Wood, Stubbs Company, Louisville, Kentucky.	134
Stringless Refugee	Geo. Tait & Sons, Norfork, Virginia.	90**
Refugee (1-1000)	Chris Reuter Seed Co., New Orleans, La.	53**

*Average of 7 plats.

**The Stringless Refugee and Refugee (1-1000) were slightly more resistant to bacterial blight than the other varieties. The low yields of these two varieties were due in part to their being severely infected with mosiac.

TABLE 13

Yields of Different Varieties of Wax Snap Beans Under an Epidemic of Bacterial Blight*

Variety	Source of seed	Pounds per acre
Dwarf Golden Wax	Wood, Stubbs Company, Louisville, Kentucky.	835
Black Wax	Job P. Wyatt & Sons Co., Raleigh, North Carolina.	303
Surecrop Stringless	Chris Reuter Seed Company New Orleans, La.	156
Currie's Rust Proof	Wood, Stubbs Company, Louisville, Kentucky.	78
Pencil Pod Wax	Chris Reuter Seed Company New Orleans, La.	72

*Average of 6 plats.

OBSERVATIONS ON SEED TRANSMISSION OF PEPPER MOSAIC

In the summer of 1926, twelve pods of pepper which were badly mottled with mosaic were selected from plants showing severe symptoms of the disease. The seed from these pods were saved and planted the following spring in greenhouse flats and were later transplanted to an isolated field where peppers had never been grown before. The plants from all the selections developed normally and did not show any symptoms of mosaic at any time during the season. Seed were saved from these selections during the summer of 1927 and planted in 1928. The results from the study in 1928 were identical with those of 1927.

From these observations, it seems safe to conclude that pepper mosaic, like the mosaic disease of many other kinds of plants, is not always transmitted through the seed. In fact, it may not be carried in the seed under any conditions.

EXPERIMENTS ON THE CONTROL OF GLADIOLUS SCAB

The studies on the control of gladiolus scab caused by *Bacterium marginatum* were started in the spring of 1927. The results of the 1927 test together with a brief description of the symptoms of the disease have been published in the Quart. Bul. of the Mississippi State Plant Board 7[3]: 6-10. 1927.

In continuing these studies in 1928, two experiments were conducted. The first was planned to determine the effect of the various disinfectants on the control of scab. The second experiment was planned primarily to determine the length of time that corms could be treated with various disinfectants without injuring them.

EXPERIMENT I

In this experiment, it was necessary to use ten different varieties of gladiolus because a sufficient number of corms of a single variety was not available. The corms of each variety were divided into thirteen lots of equal number and weight. The husks were removed from all of the corms except three lots of each variety. One lot of each variety was treated with one of the disinfectants as outlined in table 14. Three lots of untreated corms of each variety were used as checks. The corms were planted April 2 four inches apart in rows three feet wide. The corms were harvested September 22 and dried for several days after which the husks were removed and the corms sorted into the various classes according to the amount of scab present.

Weights were taken on corms and cormels. The summarized results from this experiment are given in table 14.

TABLE 14

Effect of Treating Gladiolus Corms with Various Disinfectants on the Control of Scab. 1928*

Treatment	Length of time treated	% clean corms	% scabbed corms		Av. wt. in grams per plat	
			Slightly	Badly	Corms	Cormels
Husks removed						
$HgCl_2$ 1-1000	30 min.	69.6	28.6	1.8	198.5	7.7
"	1 hr.	77.1	22.9	0.0	196.4	9.6
"	2 hrs.	81.4	18.6	0.0	184.8	6.3
Uspulun 1-400	2 hrs.	66.4	28.2	5.4	187.2	7.8
"	10 hrs.	70.7	27.5	1.8	194.1	8.7
"	18 hrs.	70.4	29.6	0.0	184.7	8.1
Formalin 3-400	30 min.	45.5	33.9	20.6	197.1	6.8
Untreated	———	24.7	47.6	27.7	184.2	6.5
Husks not removed						
$HgCl_2$ 1-1000	1 hr.	78.2	21.8	0.0	201.0	8.5
Uspulun 1-400	10 hrs.	80.0	20.0	0.0	191.7	8.2
Untreated	———	23.7	40.7	35.6	185.7	6.4

*Average of 10 plats.

EXPERIMENT II

In the second experiment, the corms of the Mrs. Frances King variety, which were uniformly badly infected with scab, were divided into fifty-four lots of fifteen corms each. Each lot weighed 266 grams with the husks on. The husks were then removed from thirty-six lots. Eighteen of the lots with the husks removed were used as checks. One lot of corms with the husks on and one lot with the husks removed were then treated for a given length of time with each of the disinfectants mentioned in table 15. The time of treatment varied for bichloride of mercury and Uspulun from two to sixty-four hours and for formalin from one to thirty-two hours in this experiment. The corms were harvested, dried, and sorted as those in experiment I. The results are given in table 15.

The results of these experiments indicate:

1. Bichloride of mercury is probably the best disinfectant for the control of gladiolus scab. Uspulun is also very effective for the control of this disease. One pint of formalin in thirty gallons of water had little or no effect upon the control of this

disease even when used for thirty-two hours. The formalin used in these experiments tested 39.43 per cent by volume of formaldehyde.

2. The removal of the husks without disinfecting the corms had little or no effect upon the prevalence of scab in the resulting crop.

TABLE 15

Effect of Treating Gladiolus Corms for Varying Lengths of Time with Various Disinfectants on the Control of Scab and the Development of New Corms.

Treatment	Length of time treated	Husks removed				Husks not removed			
		% clean corms*	% badly scabbed corms*	Wt. in grams per plat		% clean corms*	% badly scabbed corms*	Wt. in grams per plat	
				Corms	Cormels			Corms	Cormels
$HgCl_2$ 1-1000	2 hrs.	56.3	12.5	503.3	3.4	88.2	0.0	407.9	4.8
"	4 "	78.9	0.0	508.3	10.0	89.5	0.0	497.0	4.1
"	8 "	76.5	0.0	517.3	22.1	100.0	0.0	555.2	14.0
"	16 "	95.0	0.0	560.0	3.2	100.0	0.0	521.7	7.1
"	32 "	100.0	0.0	356.9	0.5	100.0	0.0	606.3	3.7
"	64 "	100.0	0.0	294.3	3.3	100.0	0.0	464.8	4.5
Uspulun 1-400	2 "	76.2	9.5	400.2	5.2	74.3	8.9	434.2	13.6
"	4 "	85.7	0.0	518.5	14.4	82.4	0.0	397.8	15.3
"	8 "	64.7	8.7	416.5	23.5	100.0	0.0	462.9	10.0
"	16 "	100.0	0.0	558.7	29.9	87.5	0.0	516.6	15.4
"	32 "	94.1	0.0	593.4	35.0	94.4	0.0	414.0	15.6
"	64 "	92.4	0.0	558.9	30.2	94.4	0.0	584.5	17.5
Formalin 1-240	1 hr.	0.0	80.0	443.3	16.4	0.0	100.0	232.3	6.1
"	2 hrs.	5.0	45.0	449.7	2.3	0.0	100.0	237.3	5.9
"	4 "	0.0	100.0	334.7	6.0	0.0	100.0	216.5	3.1
"	8 "	0.0	100.0	322.7	4.6	0.0	81.3	406.4	10.0
"	16 "	0.0	87.0	426.9	10.4	0.0	91.7	335.8	11.1
"	32 "	0.0	90.5	327.3	3.5	0.0	76.9	226.7	12.9
Untreated**	—	0.3	87.8	350.4	11.7	—	—	—	—

*The per cent of slightly scabbed corms equals the difference between the sum of the per cent of clean plus the badly scabbed corms and 100.

**Average of 18 plats.

3. Disinfecting corms with the husks on seemed to be slightly more effective for the control of this disease than the same treatment on corms with the husks removed. This may be due to the fact that the husks absorb more of the disinfecting solution than the surface of the corms and upon the evaporation of the water a larger quantity of the disinfectant is carried with the husks of the corms which gives some protection after the corms are planted.

4. Gladiolus corms can be treated for long periods of time with a 1-1000 solution of bichloride of mercury or 1-400 solution of Uspulun without apparent injury. Uspulun did not cause any noticeable injury even when the corms were soaked for sixty-four hours. The soaking of the corms for thirty-two hours in a 1-1000 solution of bichloride of mercury caused noticeable injury to corms with the husks removed. Corms treated for sixty-four hours in the bichloride of mercury solution caused severe injury to the corms which resulted in a poor growth of

Fig. 1. Effect of treating Gladiolus corms for sixty-four hours in a 1-1000 solution of mercuric chloride on plant growth. Left, treated; right, untreated.

the plants (Fig. 1) and a smaller yield of new corms and cormels. When the husks were not removed the corms were not injured as much as with the same treatment when they were removed. Little can be said about the injury caused by formalin because scab was so severe on all lots treated with this solution that the disease may have reduced the yield of new corms.

5. Treating gladiolus corms for eight hours in a 1-1000 solution of bichloride of mercury without removing the husks seems to be the most promising disinfectant for the control of scab. (Fig.2).

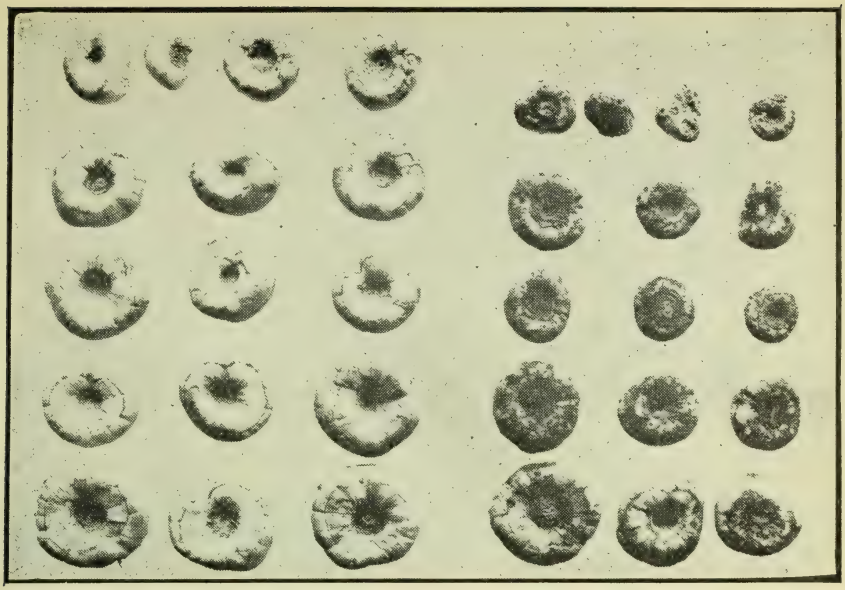


Fig. 2. Effect of disinfecting Gladiolus corms before planting on the control of scab. Left, treated for eight hours in a 1-1000 solution of mercuric chloride; right, untreated.

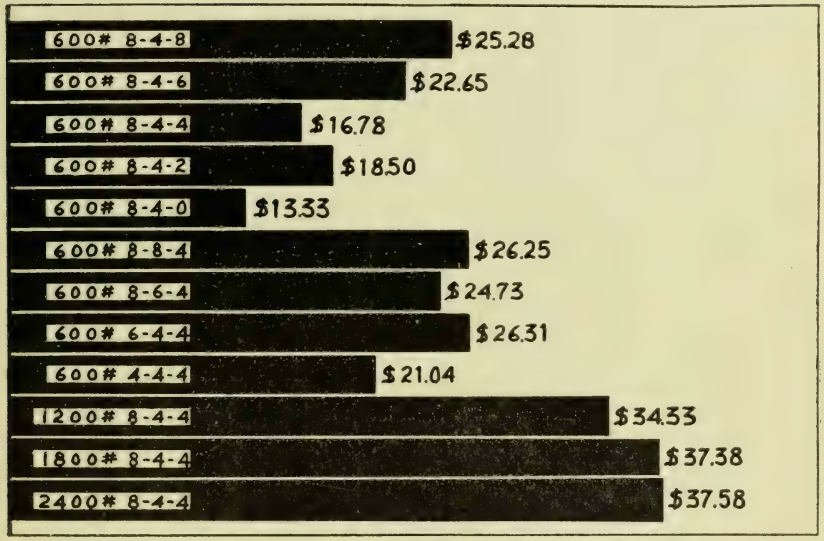
EXPERIMENTS ON THE CONTROL OF A NARCISSUS ROOT-ROT

Experiments on the control of a narcissus root-rot were conducted during the spring of 1928. The disease caused a rotting of the roots, the basal plate, and sometimes the entire bulb. The disease is apparently caused by a *Fusarium* sp. and is very much like, if not identical with, the basal-plate rot prevalent in the eastern part of the United States. Excellent control was obtained by treating the bulbs for six hours in a 1-400 solution of Uspulun or for one hour in a 1-1000 solution of bichloride of mercury. The results of this experiment have been published in Mississippi Agr. Exp. Sta. Cir. 79: 1-4. 1928.

REPORT
RAYMOND BRANCH EXPERIMENT STATION, 1928.

By

H. F. Wallace and J. L. Cooley, Jr.



Net gains over no fertilizer treatment by the use of various amounts and analyses of fertilizer_ Four year averages

Graph showing a four year average net gain of various fertilizer analyses over checks with cotton.

Mississippi Agricultural Experiment Station
A. and M. College, Mississippi.
J. R. Ricks, Director.

Report of Work at The Raymond Branch Experiment Station, 1928.

By H. F. Wallace.

INTRODUCTION

This report contains a summary of the work conducted on the Raymond Branch Experiment Station for the year of 1928. Many tables herein will give averages for a period of years, whereby results with various fertilizers and varieties will be more accurate. Other publications from this station may be secured upon request from the Mississippi Experiment Station, A. and M. College, Mississippi.

Experiments were expressly conducted to determine the kinds and quantities of fertilizers, varieties and cultural methods of cotton, corn, legume and truck crops best suited for the southern section of the Brown Loam soil area of Mississippi. Various inoculating materials for legumes have been tested and found to give about equal results. Lime has been applied to non-lime soils and good cuttings of alfalfa have resulted when planted to this crop. Beneficial results have been secured upon fertilizing fruit trees and grapes. Success has been attained in grafting paper-shelled varieties on the native seedling pecan trees.

As a crop year, 1928 presented many obstacles. The weather was favorable for the early breaking of land and one field on the station of very poor hill land, consisting of twelve acres, fertilized with 300 pounds of an 8-4-4 (PNK) fertilizer per acre and side dressed with 100 pounds of nitrate of soda per acre and planted March 31st to Cocke's Prolific corn and otootan soybeans, produced an average of 26.5 bushels of corn to the acre besides the crop of soybeans. This corn was harvested the first week in September, the corn stalks and green bean vines turned under and the entire field planted to hairy vetch which at present would furnish fairly good grazing. On the other hand, dairy cattle or stock could have grazed the green bean vines as pastures were very dry at the time.

Early cotton did not fair so well as packing rains and late frosts caused a number of people to plant the same field three or four times to secure an acceptable stand. On the night of June 13th, this immediate section received a ten inch rain that washed up much cotton on the lowlands after it had been chopped out and dirted. Cotton seed became scarce and many good farmers were compelled to reseed their land to "gin-run" seed of mixed varieties. Many cotton fields got very grassy due to frequent rains which caused the land to be wet enough to prevent cultivation. A six acre field on the station, after being chopped, had a twenty-two foot bridge to float diagonally across it without damaging a stalk of cotton. Water was about three feet deep on this field but a little over eight five hundred pound bales were produced at harvest.

The boll weevil was worse this season than it has been since 1923. Poison was applied twice to all of our plats and the fifteen acres we had in cotton produced sixteen and three-fifths five hundred pound bales. The average yield per acre for Mississippi this year is estimated at 174 pounds of lint cotton per acre which is also the ten year average. This is a higher yield than any other cotton producing state of any consequence except North Carolina.

Truck crops came in for their share of the late frosts and heavy rains, but produced fair yields which brought very poor prices.

This station faired these adverse conditions well, producing more than a bale of cotton per acre on the average, plenty of hay and about seven hundred bushels of grain. Every foot of cultivated land is now growing a winter legume of some kind and this caused a darkey visitor the other day to make this remark, "Cap, you grows your fertilizer in the winter and I buys mine in the spring."

Much credit is due our capable farm manager, Mr. J. C. Peyton, for the success attained and to Mr. J. L. Cooley, Jr., Horticulturalist, who rendered material assistance with the horticultural experiments. Mr. Cooley will report all the horticultural work in this bulletin.

COTTON

Cotton represents the principal cash crop of our State,

hence much attention has been given it from a standpoint of varieties, fertilizers, spacing and diseases.

As a cotton year, 1928 furnished many obstacles, such as excessive rains which caused grass to invade the wet fields which could not be cultivated, late frosts which injured stands causing replanting and last but not least, the boll weevil which had it not been for dry weather in the latter part of the season would have reduced the final yield materially. Due to so much replanting, good seed were not obtainable in many instances and careful farmers were compelled to plant "gin-run" seed. This, too, had a tendency to reduce final yields.

On July 21st, one field on the station had a 45 per cent infestation of boll weevils and daily showers for a period of two weeks prevented effective poisoning and the infestation increased to 100 per cent by July 31st. Another field of six acres had an infestation of 68 per cent on July 31st, but two applications af calcium arsenate reduced this to five per cent and the final yield was something over eight 500 pound bales. Many other fields were infested from 35 to 65 per cent. At the second poisoning the plant lice were beginning to get bad so to combat them, one pound of tobacco dust or "Black Leaf 40" was added to eight pounds of calcium arsenate and the lice gave no more trouble. Other conditions may have been responsible for this however.

One rain on the night of June 13th, totaled ten inches in nine hours and all fields were covered until noon the next day from one to four feet in slowly moving water which had the effect of back-water. Regardless of these disastrous troubles, our crop from fifteen acres amounted to sixteen and three-fifths bales.

A large acreage is responsible for the 1928 yield in Mississippi being as high as it is and it has also caused to a certain extent a lower yield per acre. It is evident more than ever that we should plant fewer acres to cotton and make more cotton to the acre. To aid increased production per acre, the following tables will reveal actual yields produced on our fields this past year.

Below may be seen the results with twenty-two leading varieties of cotton which were planted on both valley

and hill land, as shown in Table 1 for the valley and Table 2 for the hill test.

Table 1—Cotton Variety Test—Valley Land —1928

Variety:	Lint data				Total value per acre	Rank in val.
	lbs. lint per acre	Percentage	Length	Cents per lb.		
Cleve., 54	691.7	34.5	15-16 f	17.95	158.52	2
Cleve., 884	387.4	33.7	1 1-32	19.05	87.51	20
Cleve., Wilson	634.1	32.0	7.8 f	17.70	136.48	4
Cleve., Piedmont	557.2	32.4	7-8 f	17.70	119.54	13
Half and Half	489.9	38.9	13-16 f	17.20	98.11	19
Cook 1010	540.8	39.2	13-16 f	17.20	108.11	17
Acala 37	511.1	33.1	1 1-32	19.05	115.95	15
D. & P. L. No. 8	542.6	37.6	1	18.45	116.30	14
Rowden 40	586.1	34.3	1	18.45	128.34	6
Miller	565.0	33.8	1 1-32	19.05	127.54	8
D. & P. L. No. 4	531.5	35.6	1	18.45	115.16	16
Deltatype Webber	440.2	31.6	1 3-16	20.60	107.83	18
Delfos 910	541.2	31.7	1 1-8	19.80	128.04	7
Missdel No. 1	356.9	33.5	1 5-32	20.00	84.13	21
Delfos 911	759.7	32.3	1 5-32	20.00	180.60	1
Delfos 6102	634.0	32.2	1 3-32	19.65	148.57	3
D. & P. L. No. 6	541.3	35.2	1 3-32	19.65	124.29	9
Express 121	586.4	33.8	1 3-32	19.65	135.89	5
Lone Star 168	536.6	33.6	1 3-32	19.65	124.23	10
Lone Star 284	534.5	33.7	1 1-16	19.40	122.81	11
Lone Star 65	524.0	33.1	1 1-16	19.40	120.71	12

Table 2—Cotton Variety Test—Hill Land—1928

Variety:	Lint data				Total value per acre	Rank in val.
	lbs. lint per acre	Percentage	Length	Cents per lb.		
Cleve., 54	252.3	36.2	15-16	17.95	53.32	6
Cleve., 884	234.5	35.1	1	18.45	51.06	10
Cleve., Wilson	264.3	34.5	13-16 f	17.20	54.48	4
Cleve., Piedmont	240.3	35.0	13-16 f	17.20	49.36	13
Half and Half	254.5	40.6	3-4 f	17.20	50.45	12
Cook 1010	219.2	40.3	13-16	17.20	43.54	17
Acala 37	188.4	34.9	1	18.45	41.07	18
D. & P. L. No. 8	152.4	38.6	15-16	17.95	31.71	20
Rowden 40	167.3	36.2	15-16 f	18.20	35.74	19
Miller	188.4	34.9	1	18.45	41.07	18
D. & P. L. No. 4	277.1	37.0	15-16	17.95	47.72	14
Deltatype Webber	220.9	32.3	1 1-8	19.80	52.16	9
Delfos 910	201.1	32.6	1 3-32	19.65	46.99	15
Missdel No. 1	200.5	35.3	1 1-16	19.40	45.50	16
Delfos 911	291.1	33.5	1 3-32	19.65	67.60	1
Delfos 6102	284.5	33.6	1 1-16	19.40	65.31	2
D. & P. L. No. 6	228.4	36.2	1 1-32	19.05	50.75	11
Express 121	236.3	34.6	1 1-32	19.05	53.05	7
Lone Star 168	239.1	34.8	1 1-32	19.05	53.60	5
Lone Star 284	250.3	34.3	1 1-32	19.05	56.31	3
Lone Star 65	228.7	34.2	1 1-16	19.40	52.28	8

Recommendations:—For hill land, it has been found that Cleveland-54, Cleveland-Wilson, any of the Lone Star strains, Miller, D. and P. L. 4 and Acala are all good.

For Valley land, Delfos-6102 and any of its progenies, any of the Lone Star strains, D. and P. L. 6, Cleveland-54, Express-121, Miller and Rowden-40. If a good premium is being paid for an extra long staple, it would very probably be wise to grow Delta-type Webber on very strong land. To maintain length of staple in the long staple varieties, always plant them on strong land. Many long staple varieties are planted on the poorer classes of soils and when the sample is classed the cotton buyer sometimes gets the credit for shortening the length instead of the soil which is usually responsible.

The valley land test has been conducted for eight years, while this is the second year for the test on hill land.

At one time this year, August 4th, the hill test had a weevil infestation of 100 per cent. Both tests had two applications of poisoning in the form of calcium arsenate.

Table 3—Cotton Variety Test on Loess Soil—1928

Variety:	Lint data				Total value per acre	Rank in val.
	lbs. lint per acre	Percentage	Length	Cents per lb.		
Trice	401.2	34.1	1	18.45	87.79	10
Cleve., 54	427.6	36.2	1	18.45	92.45	4
Cleve., Wann.	423.8	37.8	7-8	17.50	86.71	12
Half & Half, Mahon	463.4	40.6	3-4 f	17.20	91.91	6
Cook 1010	481.8	40.3	13-16	17.20	95.70	1
Willis	220.4	34.7	7-8 f	17.70	46.48	18
Acala 37	362.7	34.9	1	18.45	78.04	14
Miller	431.7	34.9	1	18.45	94.13	3
D. & P. L. No. 8	453.6	38.6	15-16	17.95	94.41	2
D. & P. L. No. 4	431.4	37.0	15-16	17.95	90.65	7
Lone Star 65	324,9	34.2	1 1-16	19.40	74.28	16
Lone Star 168	382.2	34.8	1 1-32	19.05	85.68	12
Delfos 1374	284.7	33.2	1 1-8 f	20.00	67.25	17
Delfos 911	395.9	33.5	1 3-32	19.65	91.93	5
Delfos 1341	392.9	36.4	1 1-16 f	19.40	88.58	8
Express, Lightning	377.3	32.9	1 1-8	19.80	88.55	9
Deltatype Webber	356.3	32.3	1 3-16	20.60	86.83	11
Simpkin's	341.4	35.0	1	18.45	74.39	15

Cooperative Variety Test on Loess Soil:—Owing to the Loess soils near the Mississippi river, our station in cooperation with Mr. J. B. Brabston, Bovina, Mississippi, conducted a simple variety and fertilizer test on these soils.

This test was planted in three series May 1, 1928. No fertilizer was applied until the cotton was chopped, then Series 1 was side dressed with 200 pounds of nitrate of soda which gave a yield of 1093 pounds of seed cotton per acre; Series 2 was side dressed with 200 pounds of nitrophoska (30-15-15) and produced 1004 pounds, and Series 3 was side dressed with 150 pounds of sulphate of ammonia and yielded 1058 pounds of seed cotton per acre. The results of the variety test are to be found in the table listed above and it appears that the big boll varieties will probably be best suited to this hill soil. One year's results should not

be considered conclusive, however.

Fertilizers:—A majority of our visitors are more interested in fertilizers for cotton than anything else. Due to this fact, more attention has been given this than any other subject. Farmers not acquainted with cotton fertilizers seem astounded when shown that around ten dollars worth of fertilizer put under an acre of cotton will double the yield in many instances, even on fairly good land. Many are of the opinion that fertilizers are profitable only on poor land and after finding out otherwise one of our visitors remarked that it had cost him many dollars in the past because he held this opinion. Judicious use of fertilizer will increase the yield on any land suitable for the growth of cotton.

In all fertilizer work reported in this bulletin, the increase was obtained according to the standard adopted by the American Society of Agronomy as reported in Volume 16, Number 1 of the Journal. The column marked "Check yield" was obtained according to the above method by assuming that there is a gradual increase or decrease in fertility from one check plat to the other.

In testing kinds of fertilizer it is a good idea to test quantity also, so as high as 2400 pounds of a mixed fertilizer per acre has been used on the station with a four year average net gain, after paying for the fertilizer, of $37.58. All fertilized plats have produced nice profits for the past four years.

According to custom, cooperative fertilizer tests were conducted in 1928. A simple test was located north of Bovina, Mississippi, on the farm of Mr. J. B. Brabston, the results of which have already been given. Mr. Brabston gave his undivided attention to the tests located on his place.

Our main cooperative fertilizer test with cotton was located on a gray soil, peculiar to some areas in this section, on the farm of Senator H. H. Casteel, located a few miles north of Canton, Mississippi. Through some misunderstanding, these plats were picked and mixed before any weights could be recorded by station men.

Below is to be found the general fertilizer test conducted on the station as listed in Table 4.

Table 4—Analysis Test With Cotton—1928

Pounds of Material applied per acre				Pounds of Seed cotton per acre			Dollars per acre		
Acid phos.	Nitrate of soda	Mur. of potash	analysis	Plot yield	Check yield	increase	Increase at 7c	Cost of fert.	Net gain
No fertilizer				615					
300	160	100	8-4-8	1093	607.0	483.3	33.83	9.33	24.50
300	160	75	8-4-6	1149	598.4	550.7	38.55	8.73	29.82
300	160	50	8-4-4	990	589.9	400.6	28.04	8.13	19.91
No fertilizer				581					
300	160	25	8-4-2	882	559.3	323.2	22.62	7.53	15.09
300	160	—	8-4-0	784	537.3	247.3	17.31	6.93	10.38
300	320	50	8-8-4	1060	515.2	545.0	38.15	12.81	25.34
No fertilizer				493					
300	240	50	8-6-4	1074	496.0	578.5	40.50	10.47	30.03
225	160	50	6-4-4	979	498.7	480.6	33.64	7.57	26.07
150	160	50	4-4-4	968	501.5	466.8	32.68	7.00	25.68
No fertilizer				504					
600	320	100	8-4-4	1356	510.0	846.4	59.25	16.26	42.99
900	480	150	8-4-4	1440	515.9	924.1	64.69	24.39	40.30
1200	640	200	8-4-4	1794	521.8	1272.7	89.09	32.52	56.57
No fertilizer				527					

Remarks:—This test was planted in three series to Lone Star-65 cotton on April 21, 1928, after having been fertilized on April 19, 1928. A good stand was secured but was badly damaged by a heavy frost on April 28th. On the night of June 13th, a ten inch rain completely washed up the third series and necessitated shortening the other two series to five row plats 100 feet long. Records were taken from the three inside rows on each plat to eliminate variations that might be caused from the stealing of fertilizer.

Recommendations:—It would appear that the use of six hundred pounds of an 8-6-4 for general conditions will give good results. Where lespedeza has preceded the cotton or where cotton rusts, it may be advisable to use eight per cent potash in the formula. If the land is heavily infested with coco or Johnson grass, then apply only half the nitrogen before planting and use the other half as a side dressing after chopping. Heavy red clay hill sides may not need potash in some instances, but to insure full returns

from the nitrogen and phosphorus, it is best to apply around four per cent. Always remember that fertilizer judiciously used pays as well on fertile soil as it does on poor soil.

Where legumes have been previously grown and turned under, then four per cent nitrogen in a formula should be sufficient. In following heavily fertilized truck crops of the year before with cotton, it may be safe to cut the phosphorus and potash to half and reduce the nitrogen to four per cent.

Factory Versus Home-Mixed Fertilizers:—A test of this nature was conducted at this station for the first time this past year. Stock-run commercial 8-4-4 fertilizer was secured from the Jackson Fertilizer Company and the Meridian Fertilizer Factory and nitrophoska (30-15-15), a highly concentrated fertilizer was used against home mixed 8-4-4 goods using superphosphate of 16 per cent and Rhum's phosphate of 34 per cent for the phosphorus, nitrate of soda for nitrogen and muriate of potash for the potash. All fertilizer was applied at the rate of 800 pounds of an 8-4-4 per acre.

This test was fertilized April 30th and planted in three series May 2, 1928 to D. and P. L. No. 6 cotton. Each plat consisted of five rows 125 feet long and records were taken from the three inside rows. A ten inch rain of June 13th put this field three feet deep in water. A good stand was secured and maintained as the yields indicate.

Table 5—Factory Versus Home-Mixed Fertilizers—1928

Fertilizers used: 800 lbs. of an 8-4-4 or 200 lbs. of a 30-15-15	Pounds of seed cotton per acre			
	Plot yield	Check yield	Increase	Rank
No fertilizer	1429	1429	.....	..
Jackson 8-4-4	1725	1420	304	3
Home-mixed 8-4-4	1650	1412	237	4
Nitrophoska 30-15-15	1566	1404	162	6
No fertilizer	1396	1396	.....	..
Meridian 8-4-4	1707	1352	355	1
Home-mixed 8-4-4 (Rhum's)	1472	1307	165	5
Nitrophoska 30-15-15	1607	1263	343	2
No fertilizer	1219	1219	.....	..

Nitrogen Sources:—There are many forms of nitrogen being offered the farmers these days and in turn they look to the experiment stations for advice as to which will give them the best results. Due to this fact, quite a bit of attention has been given as to finding the best nitrogen fertilizer to use in mixing fertilizer. This is the fourth year that this test has been conducted and in the table below will be seen the 1928 results with a four year average shown in the last column of all sources except Leunasalpeter which is averaged for only three years.

This test was fertilized April 20th and planted in three series to Lone Star-65 cotton on April 21, 1928. A heavy frost on April 28th retarded the growth and injured the stand to an average extent. On the night of June 13th, the above mentioned rain submerged this land to a twenty inch depth until noon the next day and completely washed up the third series to the depth of the plow. Records were taken from the three inside rows of each plat on two series only. There can be no doubt but that some sources lost more nitrogen than others in leaching during this rain. All plats, including checks received a blanket application of 600 pounds of an 8-0-4 fertilizer per acre.

This past year, as well as the four year average, shows calcium nitrate to be leading the other sources. The long growing season for the past two years has no doubt, been more favorable to the slowly acting forms of nitrogen. In using some forms of nitrogen in fertilizer mixtures, extreme care should be taken not to mix up more than can be put out within eight hours as chemical reactions take place that cause changes in the mechanical condition of the fertilizer as well as the loss of nitrogen to the air.

Below may be seen the tabulated results of this test.

Table 6—Nitrogen Sources Test With Cotton—1928

Pounds of material applied per acre	Pounds of seed cotton per acre: Plot yield	Check yield	Increase	Four year average seed cotton increase lbs.	Rank
No fertilizer	959.3	959.3	——	——	..
150 Ni. Soda	1180.6	930.5	250.1	274.2	3
112.5 sul. ammonia	1154.5	901.7	252.8	239.9	5
86.5 Leunasalpeter	1043.7	872.9	170.8	246.5*	4
No fertilizer	844.1	844.1	——	——	..
105 Cal. cyanamid	1012.9	835.6	177.3	187.4	6
150 Cal. nitrate	1224.6	827.0	397.6	285.9	1
48.9 Urea	1176.0	818.5	357.6	280.1	2
No fertilizer	810.0	810.0	——	——	..

Note—Each carrier equivalent to 150 pounds nitrate of soda per acre * Leunasalpeter carries a three year average only.

All plats, including checks, were fertilized with 300 pounds superphosphate and 50 pounds muriate of potash per acre.

Potash Sources:—Like the nitrogens, there are several forms or sources for potash. Among these sources, we have tested for three years kainit, muriate and sulphate of potash. Muriate has led each year in our tests. Kainit contains 12 per cent available potash and muriate and sulphate contain around 50 per cent.

When cotton rusts badly it signifies a deficiency of potash in the soil and an application of 100 pounds of muriate or sulphate of potash or 400 pounds of kainit per acre will come nearer correcting this condition than anything we know of. In our test this year, the plats containing potash in the above forms held foliage six weeks longer than the plats fertilized with only nitrogen and phosphorus. It is evident, in this case, that phosphorus and nitrogen do their share in maintaining a vigorous, healthy plant, but it remains in the power of potash to cause the plants to retain its leaves. It is our opinion that a liberal application of a well balanced fertilizer and pure seed will do more to ward off disease than anything else.

This test was planted in four series on land that is suffering for the want of potash. All plats including checks received the same quantity of phosphorus and nitrogen and

the table reveals the sources and amounts of potash applied to the others. Plats consist of five rows, each 125 feet long, but records were obtained from the three inside rows in each case. Fertilized May 3, 1928, on the basis of 600 pounds of an 8-6-4 fertilizer per acre and was planted to Lone Star-168 cotton on May 8, 1928. On August 1st, this field had a boll weevil infestation of 63 per cent, which was reduced to 15 per cent by an application of calcium arsenate and on August 16th, it had climbed to 34 per cent and another poisoning reduced it to below 10 per cent, where it remained the rest of the season.

Results of this test may be seen in the table listed below.

Table 7—Potash Sources Test With Cotton—1928.

Fertilizer used: (800 lbs. 8-6-0 applied generally:	Pounds of seed cotton per acre			
	Plot yield	Check yield	Increase	Rank
No potash	1058.0	1058.0	——	..
50 lbs. muriate	1344.0	1016.0	328.0	1
50 lbs. sulphate	1279.0	973.0	306.0	2
200 lbs. kainit	1194.0	931.0	263.0	3
No potash	888.0	888.0	——	..

Cotton Spacing Work:—Increased yields in cotton for the past few years have been influenced by close spacing and proper fertilizing more than any other cause. The cotton grower today realizes that to get maximum yields he must have a good stand and to inform him, work of this nature has been conducted for the past four years on this station. In order to avoid all possible error, each plat was thinned by hand and each space measured. After the last picking was made, the stalks were again counted on each plat in order to account for those that died from natural causes or lost by other means. All plats were fertilized exactly alike, planted the same time and treated alike in every respect.

Below may be seen the results of this test in table form.

Table 8—Cotton Spacing Test—1928.

Number of stalks Plot	Foot	seed cotton per acre	Four year average 1925-26-27 and 28 Stalks per foot	Yield per acre	Rank in Yield
754	1.01	1761.8	.91	1732.9	5
1284	1.71	1924.7	1.62	1837.0	3
1896	2.53	1905.3	2.18	1861.2	2
2497	3.33	1785.7	2.81	1811.6	4
3138	4.18	1891.0	3.10	1893.3	1

Remarks:—The above test was made on improved valley land that made one and one-third bales of cotton per acre as an average for the six acres in the field. On April 28, 1928, 800 pounds of an 8-6-4 fertilizer was applied per acre and D. and P. L. No. 6 cotton was planted on May 2nd. This test was under water for a few hours on three occasions; the ten inch rain on the night of June 13th, covered it to a depth of three feet. The boll weevil also caused trouble, the infestation being 68 per cent on July 31st, which a poisoning reduced to 6 per cent by August 6th and on August 16th, the infestation was 11 per cent, which was brought to under ten per cent by another application of poison for the remainder of the season.

This test was planted in six series and an endeavor made to bunch the cotton a foot apart, leaving one, two, three, four and five stalks in each bunch on the respective plats. As has been mentioned, this was accomplished by hand and rule.

Recommendations:—A four year average indicates two to three stalks in bunches per foot on three and one-half foot rows on valley land.

For hill land, use three foot rows and leave three to five stalks in bunches every foot. The poorer classes of soils will stand much closer spacing than the fertile soils. Quick maturing, medium sized, small leaved varieties will also stand closer spacing than the slow growing, large leaf varieties.

To insure a good stand, plant one and one-half to two bushels of good seed on well prepared, slightly elevated rows from April 10th to the 25th and then put in a crop of

corn and soybeans for feed. In the meantime the cotton germinates and if it should get grassy, run around it with a side harrow. Do this twice if necessary, but permit the cotton to get some growth before chopping and the weak plants will probably die out during this time and then it will be a hard proposition for any hand to cut out many of the pretty stalks. While waiting for the cotton to get large enough to chop, then March or early planted corn and beans will be about ready for a hoeing and a side dressing of some form of nitrogen, then it will make without further assistance if necessary and all attention can be given the cotton. This plan is being practiced by a staunch supporter of the station on his 1,200 acre farm near Raymond and he always makes good crops of cotton and has corn to sell every year.

Bear in mind that the young cotton plants should become well established before chopping. More cotton can be made on fewer acres by the proper use of fertilizer, good varieties, practical cultural methods and close spacing as recommended above.

Seed Treatment for Seed-Borne Diseases of Cotton:— Tests were made in cooperation with the Department of Plant Pathology of the Experiment Station and the State Plant Board, the plan and treatments being furnished by Dr. D. C. Neal, Plant Pathologist, A. and M. College, Mississippi. Promising results have been obtained in the corn growing sections to the north of us by the use of these organic mercury disinfectants for the control of corn root, stalk and ear rots. The Bayer Chemical Company and the Du Pont Company are pushing the sales of these organic mercuries in this territory and to be able to answer inquiries, this test was made for the first time this year on the Raymond station.

Table 9—Seed Treatment Work—Cotton—1928.

Seed Treatments:	Pounds of seed cotton per acre: Plot yield	Check yield	Increase	Rank
No treatment	971.5	971.5	.....	..
Upsulum	1039.3	977.1	68.2	5
Iodine with Bentonite	1113.5	982.7	130.8	1
Iodine with Kieselguhr	1079.1	988.3	90.8	2
No treatment	993.8	993.8	.....	..
Dust Corona Merco	1049.2	973.3	75.9	3
Dupont K-I-C	1026.2	953.0	73.2	4
Dupont K-I-B	997.1	932.7	64.4	6
No treatment	912.4	912.4	.....	..
Special Bayer No. 6X	877.5	940.4	-62.9	8
Special Bayer No. 100	997.4	968.4	29.0	7
No treatment	996.3	996.3	.....	..

Remarks:—Results in the above table are in line with similar work on a much smaller scale at the Holly Springs station last year. The above test was conducted in two series on medium valley land that had a white clay base. Plats consisted of three rows, each 208 feet long in one series and 125 feet long in the next. Six hundred pounds of an 8-6-4 fertilizer were applied April 23rd, and Lone Star-65 cotton treated eight different ways was planted April 24th. Seed of the same lot with no treatment whatever were planted on every fourth plat to serve as checks. The highest weevil infestation was 65 per cent on August 1st and two applications of poison kept it under control for the remainder of the season.

This work appears to have great promise and the above table is submitted for the use of those interested.

CORN

Mississippi has very few farmers that make enough corn to properly feed their livestock throughout the year. If food for the home and feed for the livestock were raised and then the balance of the time devoted to growing cotton, then there is no doubt but that a better price could be secured for cotton. The time has been when bankers and

supply merchants could have been blamed for this as practically all accounts were secured with so many bales of cotton. These days a banker is eager to lend money on pure bred livestock, especially for dairying purposes, provided the party is reliable. A few good cows quickly grow into a profit producing herd and a herd of cattle call for corn and legumes for feed. Growing legumes in every row of corn should be practiced on every farm as there is no better soil builder at a cheaper price. About six or seven pounds of laredo or otootan soybeans will plant an acre when planted in the row with the corn.

On November 1st, 1928, it was estimated that only one and one-half per cent of the 1927 corn crop remained on Mississippi farms. The average yield per acre last year was 17.8 bushels and the estimate for this year's crop is 14.5 bushels per acre. The ten year average acre yield is 16.8 bushels. This situation makes it plain to us that it will be necessary for Mississippi to purchase many dollars worth of corn from other states. The plan mentioned above in regard to planting corn and soybeans while waiting for the cotton to get large enough to chop out will help toward remedying this situation.

The work here includes variety tests, fertilizer tests, nitrogen sources, corn and bean tests and mercurial treatments for seed-borne diseases of corn. These tests should prove interesting as well as beneficial.

Below may be seen the results of the variety test which was planted in six series to eighteen leading varieties on May 25th, and was harvested October 10, 1928. Four hundred pounds per acre of an 8-4-4 fertilizer was applied before planting and when the corn was knee high it was hoed and side dressed with 100 pounds of nitrate of soda per acre. This test was planted in three foot checks on three and one-half foot rows.

Table 10—Corn Variety Test—1928.

Variety:	Yield in bushels shelled corn per acre	Percentage of grain	Rank 1928	Av. bushels 1922-28	Av. Rank 1922-28
Mosby-Station	53.7	78.25	11	33.7	5
Mosby-Delta	70.3	80.84	1	36.5	4
Mosby-D. & P. L.	54.4	78.27	10		
Mosby-Suttle	35.3	81.91	17		
Cocke's Pro.-Station	59.1	80.56	8	36.9	2
Cocke's Pro.-Delta	42.7	79.17	15	32.2	8
Hastings	58.1	80.39	9	33.4	6
Delta Prolific	59.4	80.00	7		
College-47	62.0	77.42	5		
Laguna	64.0	76.69	4	38.7	1
Mexican June	39.8	76.50	16	32.7	7
Paymaster-Neal	68.9	78.75	3	36.7	3
Paymaster-Fisher	70.1	78.56	2		
Yellow Dent-Ferguson	49.2	77.14	12		
Yellow Dent-Station	47.7	78.23	13		
Golden Dent-R. H.	31.6	76.50	18		
Golden Dent-Station	61.5	76.06	6		
Golden Dent-Standifer	47.2	77.78	14		

Remarks:—In the above table, the 1928 results will be found in the first three columns of figures. The fourth column shows the seven year average yeild of 8 varieties, while the last column shows the rank for seven years. This test was planted after a crop of vetch that followed cotton last year and at present another vetch crop, which is now growing beautifully, would stand grazing.

It is interesting to note that the leading variety produced 38.7 bushels of corn more per acre than the trailer, which in turn produced 14.8 bushels more than the ten year average yield in Mississippi. Delta Mosby leads this test with 70.3 bushels shelled corn per acre and Fisher's Paymaster was a close second with 70.1 bushels. In a seven year average of eight varieties, Laguna leads with 38.7 bushels per acre with Station Cocke's Prolific second with 36.9 bushels. The difference between the leader and the trailer in this case is 6.5 bushels per acre.

The Mosbys are subject to weevil damage in this section if planted early. Cocke's Prolific, Laguna, Paymaster

and Hastings are all good varieties to use. For late plantings, use Mexican June or Laguna.

Table 11—Nitrogen Sources Test With Corn—1928.

Pounds material applied per acre:	Bushels ear corn per acre			Per cent increase	
	Plot yield	Check yield	Increase	1928	Three year average
Check	12.0	12.0	.....	.....	.....
200 Nitrate of Soda	27.1	13.4	13.7	102.2	70.8
146.3 Sul. ammonia	23.6	14.9	8.7	58.4	35.4
115.4 Leunasalpeter	32.3	16.3	16.0	98.1	53.0
Check	17.7	17.7	.....	.....	.....
138.0 Cal. cyanamid	27.1	17.1	10.0	58.5	45.6
200.0 Cal. nitrate	34.8	16.6	18.2	109.5	75.8
65.2 Urea	26.7	16.0	10.7	66.9	62.6
Check	15.4	15.4	.....	.....	.....

Note—All plots including checks received 300 pounds superphosphate and 200 pounds of kainit per acre.

Remarks:—The last column of figures in the above table represents a three year average of a nitrogen sources test with corn showing the percentage of increase over the check or plat fertilized with 300 pounds of superphosphate and 200 pounds of kainit per acre. All these percentages indicate that nitrogen is very necessary.

This test was planted in three series to Cocke's Prolific corn on May 10th, after having applied the fertilizer on May 9, 1928. Frequent rains in the early season permitted this field to get grassy, but a stalk count revealed comparatively uniform stands. This test was harvested and weighed on September 24th. All plats consisted of five rows, each 125 feet long. Records were made from the three inside rows in each case.

Calcium nitrate leads in 1928 with 109.5 per cent increase over the checks, while nitrate of soda is a close second with 102.2 per cent increase. The three year average increase runs the same way with calcium nitrate 75.8 per cent and nitrate of soda 70.8 per cent increase.

Table 12—Analysis Test With Corn—1928.

Pounds of material applied per acre			Bushels ear corn per acre		
Super Phosphate:	Nitrate: soda:	Muriate potash:	Plot yield	Check yield	Increase
.....	200	....	23.2	23.2	.....
100	200	....	21.2	24.1	-2.9
100	200	50	22.9	25.1	-2.2
.....	200	50	27.5	26.0	1.5
.....	200	....	26.9	26.9	.....
.....	.....	....	13.3	26.7	-13.4
200	200	....	23.7	26.4	-2.7
200	200	50	24.8	26.2	-1.4
.....	200	....	26.0	26.0	.....

Remarks:—In this test we use 200 pounds of nitrate of soda per acre as a check, for all corn needs nitrogen in some form. The other plats vary with the addition of phosphorus and potash. The table speaks for itself, but too much confidence cannot be placed in one year's results.

This test was fertilized and planted in four series, May 10, 1928. Good stands were secured, but heavy rains very probably leached some of the fertilizer out. It is interesting to note that the plat receiving no fertilizer made 13.4 bushels per acre less than the check plat which received two hundred pounds of nitrate of soda. A stalk count on this test indicates a very uniform stand. This field was harvested September 24, 1928.

For general use in fertilizing corn, a mixture of 100 pounds of superphosphate, 150 pounds of nitrate of soda, calcium nitrate or their equivalent in pounds of nitrogen and 50 pounds of muriate of potash per acre will give good results. Where good farming and frequent cultivation is to be done, then a side dressing of from 50 to 100 pounds of nitrate of soda or its equivalent in some quick acting form of nitrogen might be profitably used. Any form of potash may be used. One must be more careful in fertilizing corn than in fertilizing cotton because corn does not require the quantity demanded by cotton and, too, it is hard to show a profit on corn if large quantities are used.

Table 13—Corn and Bean Test—1928.

Method of planting:	Bushels per acre		Decrease due to
	Plot yield	Check yield	beans in corn bu. per acre
3-Rows corn (alone)	34.70	34.70	
3-Rows Corn and Soybeans	30.50	37.12	-6.62
2-Rows Corn -1 Row Corn & Beans	40.40	39.55	.85
3-Rows Corn and Peas at Layby	40.20	41.97	-1.77
3-Rows Corn (alone)	44.40	44.40	

Remarks:—This simple test was conducted to determine the decrease in yield in corn when soybeans are planted with it. An application of 300 pounds of an 8-4-4 fertilizer was made May 24, and the test planted to Cocke's Prolific corn and Otootan soybeans on May 26, 1928. A good stand was secured except in the case of the peas at "lay-by", the drouth prevented proper germination. More work in the future is to be done along this line since some important results seem probable.

Treated Corn Work:—Seed treatment for seed-borne diseases with mercurial disinfectants was used on Cocke's Prolific corn in cooperation with Mr. H. H. Wedgworth, Associate Plant Pathologist, with the Experiment Station and State Plant Board, A. and M. College, Mississippi.

Much success has been obtained in the "Corn Belt" with these mercurial disinfectants toward controlling corn root, stalk and ear rots, but our results were to the effect that no material benefit was derived from these treatments of corn seed. It may have been the good, disease-free selected seed that caused this negative test. No conclusions should be drawn from one year's results, however. Further experiments will probably be conducted in the future along this line.

This test was conducted in six series and was harvested October 9, 1928. Two crops of sargrain had preceded this test.

Soybeans—There is no crop that is better suited for our purposes than soybeans. This crop is three-fold in benefit as it constitutes a safe feed crop, makes hay with a high grain content and improves the soil. Stock can be

carried over the winter on good soybean hay and some farmers have been known to make a crop while feeding this hay alone. Every corn field and every other field that begins to fall off in production should be planted to soybeans or peas and given a chance to come back to normal.

Twelve acres planted March 31, 1928, to Cocke's Prolific corn and otootan soybeans on the station on poor hill land which was fertilized with 300 pounds of an 8-4-4 fertilizer per acre attracted quite a bit of attention from visitors during the early fall. The beans were planted in the row with the corn with a duplex hopper and on September 1st, the corn was ready for the crib and the beans had just begun to bloom. The corn could have been harvested and the beans could have been grazed or cut for hay or saved for seed. Pastures are usually very dry at this time, so as a dairy pasture this would have been excellent. Dairymen were especially impressed while any farmer easily saw where early feed might be had for an emergency.

Below may be seen the tabulated results of the soybean test for comparative yields of hay and grain.

Table 14—Soybean Variety Test for Hay and Grain Yields—1928.

	Hay		Grain	
Varieties:	Date of cutting	Tons per acre yield	Date of cutting	Bushels per acre yield
George Washington	9-24-28	2.10	10-13-28	14.75
Ebony	9-11-28	1.98	9-24-28	17.28
Laredo	9-24-28	3.53	10-13-28	18.11
Midwest	9-11-28	1.66	9-24-28	16.03
Loxitan-483-Black	10-10-28	3.51	11-10-28	13.75
Tanloxi-483-Olive	10-10-28	3.60	11-10-28	15.33
Delta-488	10-2-28	2.29	10-13-28	12.79
Delta-491	10-3-28	2.29	10-20-28	6.96
Hollybrook	9-24-28	4.21	10-20-28	9.82
Tar Heel Black	9-24-28	3.69	10-30-28	17.61
Biloxi	10-10-28	3.01	11-10-28	12.44
Mammoth Yellow	9-24-28	2.71	10-20-28	26.89
Mammoth Brown	9-24-28	3.15	10-13-28	12.86
Haberlandt	9-24-28	2.64	10-20-28	13.09
Tokio	10-10-28	2.65	10-30-28	18.39
Otootan	10-10-28	3.19	11-10-28	14.68
Goshen	10-10-28	3.19	10-30-28	11.68
Six Weeks Peas			10-10-28	8.71

Remarks—The above test was planted June 30, 1928, after having turned a crop of crimson under the month before. Soybeans may be safely planted from March 25, to July 15, but the earlier the planting, usually the higher the yield, as the plant has more time to develop. Maturity dates of various varieties remain more or less the same regardless of when planted, that is, the otootan usually begins blooming around September 1, regardless of when planted. For other varieties we might say that the margin of difference in the dates of maturity are not nearly so great as the margin of difference in the dates of planting.

Soybeans should be cut for hay when the top pods are well formed. This is the good dough stage which makes the hay palatible and of high digestible nutrient content. The leaves will not shed much at this time.

In saving grain, cut when one-half to three quarters of the leaves have shed or on the other hand, when three-fourths to four-fifths of the pods have lost their green color. Saving beans for seed on the poorer types of soil especially is a good practice as the beans will improve the soil. If soybean harvesters are to be used the plants should be permitted to fully mature. On thin land soybeans should be planted on three foot rows and fertilized with 200 pounds of superphosphate per acre. Where soybeans have never grown before, the seed should be inoculated to get the best results from a soil improvement standpoint, as well as yields.

The above table speaks for itself. Careful study of harvest dates and yields will be beneficial to those planning to grow this crop. Again we emphasize the importance of planting soybeans in every row of corn in Mississippi.

Alfalfa—A new alfalfa fertilizer test was planted on a well drained brown loam soil with a clay base on November 10, 1928. Three tons of crushed limestone per acre were applied generally. Previous plantings of alfalfa have given excellent first cuttings, but subsequent cuttings were of a high per cent of crab grass. Lime is absolutely necessary in this section for the production of alfalfa, so for this reason alfalfa will never be grown on a commercial

scale in the non-lime lands. Two to five acres near the barn will certainly be beneficial to stock and poultry, especially during winter months. Our little field of alfalfa on the station this winter causes our neighbors "fence breakers" to come on through to graze and sometimes even we are tempted to partake of this green succulent plant with them.

HORTICULTURE

By J. L. Cooley, Jr., Horticulturist.

This station is located on the northern edge of the world famous "Crystal Springs-Hazlehurst" trucking section. For this reason the horticultural investigations have been devoted principally to truck crops. Although, the station has a variety orchard of peaches, pears, apples and cherries. Some few varieties of grapes and pecans are grown. These latter projects are for demonstration purposes, to show our visitors that these fruits can be produced with the proper attention given to pruning, spraying, fertilization and cultivation. More extensive work along this line is anticipated for the coming year, including a peach orchard fertilizer test, a strawberry variety test and tests with other truck crops.

Some plant disease work has been conducted in cooperation with the State Plant Board with tomatoes and potatoes.

Due to the importance of the tomato as one of our leading truck crops, it has received major attention. In all the following tests, the fertilizer formulae used were of the order phosphorus, nitrogen and potash. Our trucking projects, with the exception of cabbage, as reported in bulletin 252 of this station have been continued this year and may be grouped as follows:

(1). Tomatoes—
- (a). Variety yield and wilt test.
- (b). Fertilizer analysis test.
- (c). Potash formulae test.
- (d). Nitrogen source test.
- (e). Nitrogen source, side-dressing and Nitrate of Soda rate test.

(f). Long-distance shiping test.

(2). English Peas—

(a). General fertilizer test.

(b). Nitrogen source test.

(c). Variety work.

(3). Snap Beans—

(a). General fertilizer test.

(b). Nitrogen source test.

(c). Variety work.

(4). Irish Potatoes—

(a). Remarks.

Table 15—Tomato Variety Production and Wilt Test—1927 and 1928.

Variety:	Yield in lbs. per acre		Percentage picked early		Percent shippers	Percent wilt resistance	Av. size of shippers pounds
	Tot.	Shipr's	Tot.	Shipr's			
Globe	12813	7964	51.8	52.6	59.9	83	.290
Gulf States	14498	9399	59.0	64.3	64.8	52	.280
Detroit	13372	8833	47.2	54.8	66.1	47	.239
Marglobe	13387	9060	54.4	55.1	66.8	82	.257
Marvel	13607	9290	48.1	46.4	66.5	83	.231
Norton	13860	8855	51.5	49.6	63.3	81	.257
Richards	14617	8942	55.5	58.0	60.8	63	.264
Crystal Spg. Mkt.-1	12720	7600	57.7	60.2	59.8	69	.294
Marvelosa	11390	6611	52.4	53.3	57.7	77	.203
Marvana	14177	9288	59.3	57.8	64.2	42*	.217
La. Red	11743	7548	51.0	53.3	62.6	76*	.207
La. Pink	12824	8186	57.6	56.4	63.8	82	.231
*Kanora	7132	5150	43.9	37.6	72.2	65	.217
*Foster	8577	4720	59.9	49.9	55.0	84	.218
*Crystal Spg. Mkt.-NS	5102	3314	54.0	51.0	64.9	61	.202
*Crystal Spg. Mkt.-2	10974	7415	54.8	52.6	67.5	55	.282
*Crystal Spg. Mkt.-3	9407	6662	48.2	41.5	70.0	57	.243

Note—Varieties marked (*) were tested in 1928 only.
Wilt per cent market (*) were in only one replication.
Wilt results are for the year 1928 only. (See next to last column.)

Remarks:—The test consisted of the twelve varieties as were tested last year, with the addition of the last five varieties in the above table. These were promising and worthy of being in the test. The seed were planted in the hotbed January 25, transplanted to the coldframes March 8 and 9 and set in the field April 7. Plants were set 2 feet apart in 3½ foot rows, staked and trained to a single stem. The test was conducted in three series, using 1,500 pounds per acre of an 8-4-3 fertilizer with a combination nitrogen source of equal pounds of nitrogen from nitrate of soda, sulphate of ammonia and cottonseed meal.

Three separate series of this variety test were inoculated with a culture of fusarium wilt organisms, for a wilt resistance test. This test was given the same treatment as in the variety yield test.

Results—The Gulf States, Marvel, Marvana, Marglobe, Richards, Norton and Detroit varieties, respectively, produced the largest yields of shipping tomatoes.

Kanora, Crystal Springs Market No. 2 and 3, Marvel, Marglobe, Detroit and Gulf States varieties, respectively, produced the highest percentage of shippers.

Crystal Springs Market No. 1, Globe, Crystal Springs Market No. 2 and Gulf States varieties, respectivelv, produced the average largest fruit.

Foster, Globe, Marvel, Marglobe, La. Pink, Norton and Marvelosa, respectively, were the most wilt resistant.

Many growers mix Globe and Gulf States plants and claim to get a better pack with most of the "shake" eliminated for shipping. Globe, Gulf States, Richards, Marglobe and Crystal Springs Market varieties are grown extensively in this trucking section.

Table 16—Analysis Test With Tomatoes (average) 1926-27 and 28.

Analysis	Yield in lbs. per acre		Percent shippers picked early		Dollars per acre		
	Total	Shippers	Total	Shippers	Value at 6c	Cost of fert.	Net gain.
			(1500 pounds per acre)				
10-3-3	12290	6497	52.8	40.9	40.6	389.82	19.74	370.08
8-3-3	13005	7873	60.5	44.5	40.7	472.37	18.05	454.32
8-4-3	14376	8833	61.3	46.9	40.4	529.98	21.01	508.97
8-5-3	13551	9357	69.4	42.1	42.0	561.42	23.96	537.46
			(2000 pounds per acre)				
10-3-3	14186	9148	64.4	48.7	40.5	548.88	26.32	522.46
8-3-3	13497	8294	61.4	44.2	43.0	497.64	24.07	473.57
8-4-3	11105	6706	60.3	43.2	38.7	402.36	28.01	374.35
8-5-3	13740	9205	66.0	41.4	42.3	522.30	31.95	520.35

Remarks—This test was conducted to determine the best fertilizer analysis for producing the commercial crop. The test was in three series and the above table represents a three year average of the results. The past season was very unfavorable. The rainfall was so great at planting time that plants were set three times before a sufficiently good stand of living plants could be obtained, making the crop four weeks late. The plants that lived were of the Globe variety. Plants were set 2 feet apart in 3½ foot rows, staked and trained to one stem. The plants were topped with four clusters of fruit. Fruit was harvested in the "green wrap" stage.

The fertilizer formulae used were as stated in the above table. The combination nitrogen source was used, derived from equal pounds of nitrogen from nitrate of soda, ammonium sulphate and cottonseed meal. Potash was derived from sulphate of potash and the phosphorus from 16 per cent superphosphate.

Results—A 1,500 pound per acre application of an 8-5-3 was the leading analysis. A 2,000 pound application of a 10-3-3 and an 8-5-3 analysis gave the second best returns.

Table 17—Average Results of Potash Tests With Tomatoes—1924, 25, 26, 27, and 28.

Analysis	Yield in lbs. per acre		Percent shippers	Percent picked early		Dollars per acre		
	Total	Shippers		Total	Shippers	Value at 6c	Cost of fert.	Net gain
			(1000 pounds per acre)					
8-4-0	12055	6359	52.0	43.3	52.5	381.54	10.44	371.10
8-4-3	12743	6680	49.4	50.0	49.2	400.80	12.00	388.80
8-4-6	13769	6315	45.4	47.2	53.2	378.90	13.56	365.34
			(1500 pounds per acre)					
8-4-0	13121	6745	49.0	42.8	52.3	404.70	15.66	389.04
8-4-3	12068	6275	50.2	48.4	47.4	376.50	18.00	385.50
8-4-6	12244	6902	55.0	44.5	47.8	414.12	20.34	393.78
			(2000 pounds per acre)					
8-4-0	12686	6533	48.7	41.1	50.8	391.98	20.88	371.10
8-4-3	13254	7135	48.8	46.4	52.6	428.10	24.00	404.10
8-4-6	11162	5535	39.4	34.6	35.1	332.10	27.12	304.98

Remarks—This test was conducted to determine the most economical amount of potash to use in producing the commercial crop. The same difficulty in securing a living stand of plants was encountered as in the preceding test. Plants of the globe variety were set 2 feet apart in 3½ foot rows, staked and trained to a single stem. The plants were topped at four clusters of fruit. The test was in three series. Fruit was harvested in the "green-wrapped" stage.

Muriate of potash was the source of potash, phosphorus was derived from 16 per cent superphosphate and the combination source of nitrogen (as given in the preceding test) was used.

Results—The above table of results represents a five year average and should be very dependable. In the 1,000 and 2,000 pound applications, the 8-4-3 formula gave the highest net returns per acre. It is our opinion that the potash percentage should be varied according to the different soil types, the sandy soils requiring the more potash. We feel safe in recommending at least 3 or 4 per cent potash on average soils, believing this will enable the plants to make a better use of the available nitrogen and phosphorus fertilizers. From observations, a more stockily built plant and a better colored fruit results from the use of potash in tomato fertilizers.

Table 18—Average Results of Nitrogen Source Tests With Tomatoes—1924-25-26-27 and 28.

Nitrogen sources:	Yield in lbs. per acre		Per-cent ship-pers	Percent pkd. early		Total value, dollars	RANK
	Total	Shippers		Tot.	Shp'rs		
(1500 pounds of an 8-4-3 per acre)							
Nitrate of soda	10266	5673	52.9	45.6	52.8	340.38	1
Ammonium sulphate	9177	4707	50.2	52.5	53.6	282.42	5
Combination	9891	5640	53.8	48.4	49.6	338.40	2
Urea	9671	5421	53.8	47.7	51.6	325.26	4
Cottonseed meal	10030	5434	52.6	46.4	46.2	326.04	3
(2000 pounds of an 8-4-3 per acre)							
Nitrate of soda	10373	5642	52.5	48.6	52.8	338.52	3
Ammonium sulphate	10179	5468	52.7	53.0	55.9	328.08	5
Combination	11091	5627	50.2	48.6	53.5	337.62	4
Urea	10966	6065	54.2	50.4	54.1	363.90	1
Cottonseed meal	10707	5859	53.1	47.4	51.0	351.54	2

Remarks—The above test was conducted to determine the best source of nitrogen to use in a fertilizer formula for producing tomatoes commercially. The same difficulty was encountered in securing a living stand of plants as given in the two preceding tests. Plants used were of the Globe variety, set 2 feet apart in 3½ foot rows, staked and trained to a single stem. Plants were topped with four clusters of fruit. The fruit was harvested in the "green wrap" stage of ripeness.

Where a combination nitrogen source is listed, it means that the nitrogen was derived with equal pounds of nitrogen from nitrate of soda, sulphate of ammonia and cottonseed meal. The other nitrogen sources were as indicated, phosphorus derived from 16 per cent superphosphate and the potash from sulphate of potash.

Results—The above table represents average results over a five year period. In the 1,500 pound application, nitrate of soda is the leading source, returning a total production value at $340.38, followed by the combination source with a like value of $338.40.

In the 2,000 pound application used, cottonseed meal and nitrate of soda, respectively, were the leading sources. All sources appear to be better than ammonium sulphate.

Table 19—Average Results of Nitrogen Sources, Side-dressing and Nitrate of Soda Rate Tests—1927 and 28.

Amount per acre of 8-4-3	Sources of Nitrogen	Yield in pounds per acre. Total	Shippers	Percent Shippers.	Percent picked early. Total	Shippers.	Total value dollars.	RANK
	(Nitrogen Source Test)							
1500	Nitrate of soda	11360	7556	66.5	52.2	47.6	453.36	3
1500	Amm. sulphate	9177	5558	60.9	57.9	46.4	333.48	7
1500	Combination	11245	7601	67.6	58.7	49.4	456.06	2
1500	Urea	10804	6976	64.6	52.1	52.1	418.56	5
1500	Cottonseed meal	11433	7105	62.1	50.7	38.7	426.30	4
1500	Nitrate of soda / Cottonseed meal	12802	8671	67.7	55.5	53.3	520.26	1
1500	Amm. sulphate / Cottonseed meal	10821	6658	61.5	54.0	53.0	399.48	6
2000	Nitrate of soda	11515	7640	66.4	52.9	50.3	458.40	2
2000	Amm. sulphate	11820	7426	62.8	59.2	54.9	445.56	4
2000	Combination	11332	6699	59.1	51.0	50.9	401.94	7
2000	Urea	12265	7566	61.7	57.3	56.1	453.96	3
2000	Cottonseed meal	11672	7402	63.4	56.7	50.1	444.12	5
2000	Nitrate of soda / Cottonseed meal	12179	7684	63.1	57.6	56.4	461.04	1
2000	Amm. sulphate / Cottonseed meal	11685	7069	60.5	49.2	57.0	424.14	6
	(Nitrogen source and Side-dressing Test)							
1000	No. of So., 200 No. So.	12080	8048	66.6	40.6	49.7	482.88	2
1000	C. S. Meal / Ni. So., 200 lbs Ni. So.	10649	7157	67.2	48.9	54.9	429.42	3
1000	Cot'nseed ml., 150 Amm / Amm, sulphate, sul. ..	10693	7075	66.2	58.8	58.8	424.50	4
1000	C. S. ml., 200 Ni. So.	11709	8249	70.4	48.7	58.2	494.94	1
	(Nitrate of Soda Rate Test)							
1000	Nitrate of Soda	11476	7415	64.6	42.1	56.1	444.90	3
2500	Nitrate of Soda	12635	8843	70.0	51.0	55.8	530.58	1
3000	Nitrate of Soda	10826	7445	68.7	59.2	57.7	446.70	2

Remarks—The above tests were conducted to determine the best nitrogen sources, nitrogen side-dressing carriers and rates of nitrate of soda per acre in a complete fertilizer, for producing a commercial crop. This test was conducted as a part of the preceding nitrogen source test and all details of the two tests are alike. The nitrogen side-dressings were applied when the first fruit were about one-half grown.

Results—In the above table a two year average of results of this test is given. The past season was very unfavorable, the crop was very late and received too much rain; which, it seems to the writer, would favor the slower-acting organic forms of nitrogen.

In the 1,500 pound application, the combination source of nitrate of soda and cottonseed meal, the combination source and nitrate of soda alone were the leading sources with per acre production values of $520.26, $456.06 and $453.36, respectively.

In the 2,000 pound application, the combination of nitrate of soda with cottonseed meal, nitrate of soda and urea sources gave the largest per acre returns with productions valued at $461.04, $458.40, and $453.96, respectively.

In the nitrate of soda rate test, the 2,500 and 3,000 pounds per acre rates both were superior to the 1,000 pound rate with respect to total money value of the crop. This tends to prove that heavy applications of nitrate of soda are not injurious to the crop, but give the best results.

In the nitrogen source and side-dressing test, nitrate of soda as a side-dressing with cottonseed meal or nitrate of soda as the formula source, respectively, were the two leading source and side-dressing combinations with per acre productions valued at $494.94 and $482.88. Nitrate of soda as the side-dressing, in every case, gave much better results than sulphate of ammonia.

Long-distance Shipping Test—To meet the present-day arguments that nitrate of soda injures the shipping and keeping quality and causes "puffs" with tomatoes, this test has been conducted. Two shipments of one basket each (about 17 fruit) from plots using an 8-4-3 formula, where nitrate of soda was the only source of nitrogen at the rates

of 1,000, 2,000, 2,500, and 3,000 pounds per acre were made by local express to the Bureau of Agricultural Economics, U. S. D. A., New York City, for a careful and rigid inspection. The baskets were marked repsesentative numbers so that the inspectors did not know any of the details of the test and that an unbiased report could be obtained.

Results—Average results from these reports give the following data:

Long-distance Shipping Test—1928

No. of fruit:	Fertilizer rates per acre:	Percent of marketable fruit		
		On arrival:	5 days later:	10 days later:
34	1000 lbs.	94.3	100.0	84.4
34	2000 lbs.	94.2	83.8	86.2
34	2500 lbs.	97.3	88.3	100.0
34	3000 lbs.	97.3	81.3	87.1

All packages arrived in good condition and with a tight pack. It is evident that these fruit were subjected to a much more severe treatment than would have been the case had they been in car-load lot shipments.

These reports show no shriveled marketable fruit. Slight injuries are reported from molds, fusarium, soil rot, Rhizopus rot and growth cracks. Of the 136 fruit, there were but four with crate scars and no "puffy" fruit. This test indicates that the shipping and keeping quality of the tomatoes were very good and that these results are even better with the heavier applications. These results compare favorably with those for 1927.

Table 20—Average Results of English Pea Fertilizer Work—1924-25-26-27-28.

Analysis:	Yield per acre pounds	Dollars per acre		
		Value at 5c	Cost of fertilizer	Net gain
	(1000 pounds per acre)			
10-3-3	3768	188.40	11.59	176.81
8-3-3	3331	166.55	10.49	156.06
8-4-3	3432	171.60	12.00	159.60
	(1500 pounds per acre)			
10-3-3	3609	180.45	17.39	163.06
8-3-3	3593	179.65	15.74	163.91
8-4-3	3535	176.75	18.00	158.75

Table 21—Average Results of Nitrogen Sources Test With English Peas—1924-25-26-27-28.

Rate per acre	Yield in pounds per acre using		
of an 8-4-3 lbs.	Nitrate of soda	Sulphate of ammonia	Combination
1000	4310	4285	3392
1500	4128	4030	3623

Remarks—This test was conducted on a sandy loam soil with a deep clay sub-soil. It was fertilized and planted February 11, in two series. In table 20, the nitrogen was derived from a combination of equal pounds of nitrogen from nitrate of soda, sulphate of ammonia and cottonseed meal. In table 21, the nitrogen was derived from sourses as indicated, and in both tests the phosphorus was derived from 16 per cent superphosphate and the potash from muriate of potash. The Thomas Laxton variety was planted in both tests.

Results—The results given in both tables represent an average for a five year period. In the general fertilizer test, 1,000 pounds per acre of a 10-3-3 fertilizer produced the best results, with a 1,500 pound application of a 10-3-3 and an 8-4-3 giving second best results.

In the nitrogen source test, nitrate of soda gives the best results in both the 1,000 and 1,500 pound applications. Sulphate of ammonia gives second best results with the combination source ranking last. This crop must be produced early and the more quickly available sources are to be recommended.

English Pea Variety Test—This test consists of five of the leading varieties in this trucking section and was conducted in three series. The Thomas Laxton and Gradis (Rice) varieties were a few days earlier than the other three. To lead the test, Gradis (Allen) yielded 5,548 pounds per acre. Thomas Laxton was second best with a yield of 4,388 pounds. Gradis (Rice) yielded 3,266, Record (Kerney) 2,814 and Record (Allen) 2,684 pounds.

The test was attacked by a bacterial blight. Gradis (Allen) was the most resistant. The Thomas Laxton variety has fairly large pods and peas and is of good quality.

Table 22—Average Results of Snap Bean Fertilizer Test —1924-25-26-27-28.

Analysis	Yield per acre pounds	Dollars per acre Value at 5c	Cost of fertilizer	Net gain
	(1000 pounds per acre)			
10-3-3	4015	200.75	11.59	189.16
8-3-3	3663	183.15	10.49	172.66
8-4-3	3689	184.45	12.00	172.45
	(1500 pounds per acre)			
10-3-3	4123	206.15	17.39	188.76
8-3-3	3579	178.95	15.74	163.21
8-4-3	3986	199.30	18.00	181.30

Table 23—Average Results of Nitrogen Sources Test With Snap Beans—1924-25-26-27-28.

Rate per acre of an 8-4-3, lbs.	Yield in pounds per acre using Nitrate of Soda	Suplhate of Ammonia	Combination
1000	3649	3833	3671
1500	4012	3858	3867

Remarks—This test was conducted in two series and planted March 20. The first picking was made May 29. The above tables represent average results over a five year period. In the fertilizer formula test the nitrogen was derived from a combination of equal pounds of nitrogen from nitrate of soda, sulphate of ammonia and cottonseed meal. In the nitrogen source test the nitrogen was derived from sources as indicated. In both cases the phosphorus was derived from 16 per cent superphosphate and the potash from muriate of potash. The valentine variety was used throughout the two tests. Six rows were attacked by a bacterial blight so seriously that they were discarded from the test.

Results—The above results represent a five year average and appear to favor a 1,500 pound application of a 10-3-3, with 1,000 pounds per acre of an 10-3-3 giving second best results.

In the nitrogen source test, the nitrate of soda source in the 1,500 pound application gave the highest returns per

acre. In the 1,000 pound application sulphate of ammonia was the leading source.

No correlation could be observed between the bacterial blight and the different fertilizer treatments.

Snap Bean Variety Test—This test consisted of the three leading varieties grown in this trucking section and were Valentine, Wax (yellow) and Giant Stringless Green Pod. The planting and first picking dates are the same as for the fertilizer work with beans. The test was planted in three series, using 1,000 pounds per acre of a 10-3-3 fertilizer with a combination nitrogen source consisting of equal pounds of nitrogen from nitrate of soda, sulphate of ammonia and cottonseed meal. Muriate of potash and 16 per cent superphosphate were used in the formula.

The first picking was made on May 29 and no difference could be observed in earliness. The Valentine variety was the leading with a yield per acre of 3,896. The Wax yielded 3,849 and the Giant Stringless Green Pod 2,648 pounds per acre. This test was attacked by the same bacterial blight as in the above two tests and the giant Stringless Green Pod variety was almost 100 per cent resistant.

Irish Potato Work—More attention should be given to the source of seed when planting an Irish potato crop. To impress this feature, this station has cooperated with the State Plant Board, in which Mr. H. H. Wedgworth has secured certified seed from northern grower's associations to test against seed secured locally. Largely due to the results obtained from these experiments, the use of certified seed by Mississisippi growers has been increased from a few bushels in 1925 to approximately 20,000 bushels in 1928. An average of the four years results from the cooperating Mississippi Experiment Stations may be obtained in circular form (Circular No. 80) from the Mississippi Experiment Station, A. and M. College, Mississippi. An extract from this circular is given below:

"In each test conducted, the certified have proved superior to the uncertified seed. This has been the case especially with the Triumph variety because it is more susceptible to the mosaic disease than the Cobbler variety. The average yield per acre of marketable potatoes of 52 samples of certified Triumph seed was 120.2 bushels compared to

an average yield per acre of 84.2 bushels for 21 samples of uncertified seed of the same variety or an increase of 42.8 per cent. The average per acre yield of marketable potatoes of 28 samples of certified Cobbler seed was 163.8 bushels compared to an average yield per acre of 128.2 bushels for 7 samples of uncertified seed of the same variety or an increase of 27.7 per cent."

"The results from these tests conducted during the past four years prove that certified seed are much superior to uncertified seed. They also indicate that there is a difference in the quality of certified seed produced by individual growers within a state. Therefore, too much stress can not be placed upon the value of keeping the tags which give the name or certificate number of the grower and which accompany each sack of certified seed."

GENERAL WORK

By H. F. Wallace

Rotations—It is our policy to grow a legume on all lands at least once a year. The poorer fields grow legumes twice a year. The entire station where the fields were cultivated are now growing winter legumes alone and in some instances mixed with rye or oats. Several rotations are under way and outstanding among these is the two year rotation with cotton, vetch, corn and soybeans.

To begin this rotation, sow broadcast seventeen to twenty pounds of inoculated vetch seed at the last cultivation of the cotton. This statement is not made for those who "lay-by" cotton by July 4th, but for the real cotton farmer that cultivates up to the time cotton is nearly ready to open. This vetch germinates in the fall and matures seed around the middle of May when the entire crop should be turned under to insure a volunteer crop the following fall. After turning under, plant the land to corn and soybeans. As stated, the vetch volunteers and in the spring may be turned under or cut for hay as desired and then the land planted to cotton. Permit vetch to mature seed every other year and be insured of a volunteer stand every year. In this connection, bur clover will also reseed itself and may be used in a similar rotation.

Vetch has been grown on very poor gray land on the station and has about trebbled the yield of soybeans for hay on these lands. It should be borne in mind, however, that vetch like any other crop does better on good land, so to be successful with vetch, plant it on good land and give it a chance. One of our good, substantial farmers started the above two year rotation on sixteen acres this past year and now has a good volunteer stand on this land and in addition has planted 100 acres more.

Where vetch is to be grazed a little during the winter and later cut for hay, it is advisable to plant oats with it. If for grazing or turning under, use rye with vetch. A bushel of rye and fifteen pounds of vetch is a good seeding for an acre and one and one-half bushels of oats with fifteen pounds of vetch is a good seeding.

Legumes—Legumes may be divided into two classes,

winter and summer legumes. Much benefit has been derived from using bur clover, vetch, Austrian winter peas and crimson clover as winter legumes. Crimson clover is an annual and must be planted every year. As stated, vetch and bur clover will reseed themselves, but help the land more if turned under around the middle of April. Quite an acreage has been planted to Austrian winter peas this fall on the station as they withstood severe cold weather well last year.

Last fall an elaborate winter legume test was put in but due to being planted late, the severe cold weather of the first week of January destroyed it. This test was followed with cotton however and the check plots received 600 pounds of a complete fertilizer in the form of an 8-6-4. While the plots that grew legumes received the same fertilizer with the exception of the nitrogen. One plot in each series was left bare and fertilized in the same manner as the legume plots. Results were recorded on this test but will not be published on account of the legumes being killed out due to a very late planting. This fall the legumes, hairy vetch, monantha vetch, bur clover, crimson clover and Austrian winter peas are growing nicely and when turned under, before planting cotton, should add quite a bit to the nitrogen content of the soil.

Among the summer legumes are soybeans, velvet beans, peas and lespedeza. Lespedeza reseeds while the others must be planted each year. These legumes fit into rotations nicely and are recognized as excellent soil builders.

Pastures—Excellent pastures are easily obtained in this section by getting a start of bermuda, carpet grass, lespedeza and white clover. Paspalum grows well in the lower wet places. Early spring clovers such as the hop clover also help out on early grazing. Meadow fescue and the rye grasses also do well. Any part of this section is well adapted to dairying provided there is a good milk market within a radius of fifty miles. Many of our pastures carry cattle easily eight months in the year. Many cattle are never housed during the winter and when they are, it is for a very short period during cold, rainy spells. Carpet grass, lespedeza and bermuda are native in this section.

Some pasture work is being planned for this station

in the near future.

Orchards—A nice variety orchard produces excellent fruit each year. Peaches from this orchard were as nice as any that can be produced anywhere. Our trees are fertilized each year with an 8-4-4 fertilizer and also by the vetch that grows in the orchard each winter. This vetch is turned under in early spring. Results show that the choicest fruits may be produced by a little attention given to pruning, spraying and cultivation.

Boll Weevil Work—Hibernation and boll weevil ememgence work has been done in cooperation with Mr. O. M. Chance, Jackson, Mississippi, of the State Plant Board. At present there are cages in the woods and in the open fields that contain five hundred weevils each. These weevils were caught in the late fall and put in these cages. In the spring daily records will be kept to see how many emerge from winter quarters. Those that do not emerge will be listed as not surviving the winter, while those that emerge will give the cotton grower warning as to how bad the infestation will be during the ensuing year. Several cotton states are doing this work.

Improvements—Several improvements have been made on the station during the past year. The barn and machine shed have been painted and the two tenant houses stained green and trimmed in white. The new office has been ceiled and plastered and water and sewerage disposal has been installed in same. Folding chairs for the lecture room and three office chairs have been purchased. New rolling doors have been installed at the front of the barn. Bridges and fences have also been repaired. Shrubs have been planted around the new office building and people traveling the new concrete highway from Raymond to Jackson easily recognize the place by a beautiful new sign that has been erected east of the station residence.

Conclusion—A successful year's work has come to a close. Many visitors have come to the station and many more have written in for information.

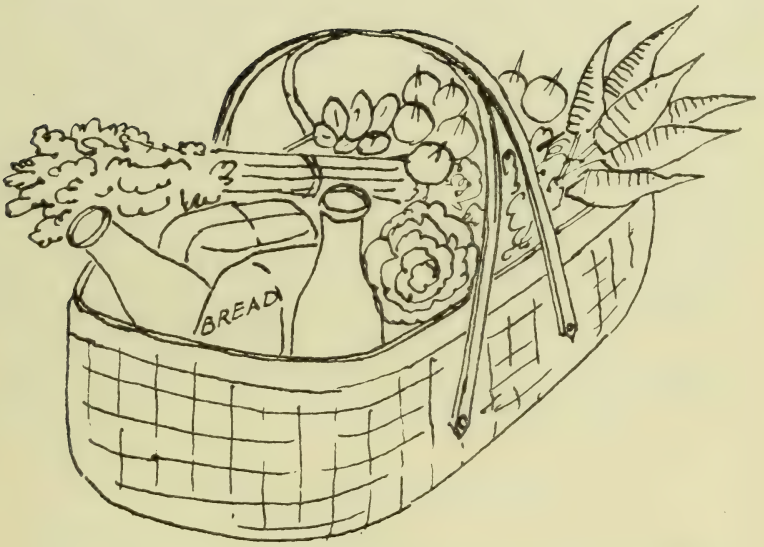
We wish to express appreciation to Dr. B. M. Walker, President of the A. and M. College, and to Director J. R. Ricks, of the Experiment Station for the kind and business-like manner in which they have directed the work of the Raymond Branch Experiment Station.

Bulletin No. ~~10~~ 263 January, 1929

MARKET BASKET WISDOM

By

Dorothy Dickins



Mississippi Agricultural Experiment Station
A. & M. College, Mississippi,
J. R. Ricks, Director

MARKET BASKET WISDOM

By Dorothy Dickins

Filling the family market basket is an ever present question. For the city housewife, it means making every penny count. For the rural housewife, it means making every minute count.

Mr. Jones of the city makes just enough to buy bare necessities for his family. Rent must be paid in order that the family be housed. A few clothes must be provided for the father and the children so they may go to work and to school. The only place to cut is on the food. Mrs. Jones, not understanding all she should about food values, makes these cuts on the most necessary foods. For instance, she considers milk at 17 cents a quart too expensive yet often buys meat at 30 cents a pound.

On the other hand, Mr. Holcomb from the country makes much less in actual cash than does his city friend. He can, however, provide his family with a good diet at much less cash expenditure, for he has land at his disposal for producing such a diet and obtains a few foods practically as a by-product of his general farm business.

This bulletin will tell how Mrs. Holcomb, a typical housewife of the rural areas of Mississippi, filled her market basket.

Adding to Family Wealth

Mr. Holcomb owned two milk cows. These were freshened six months apart, in fall and spring. Thus, an ample milk supply was insured. In fact, a surplus was produced, part of which was fed to animals, part sold.

A flock of 55 fowls, including young chickens, furnished this family with their egg requirement and some surplus from February through August. However, less than the requirement was produced in fall and winter. Better selection and care would, doubtless, have meant more eggs and

chicken for family consumption, more for sale.

Mrs. Holcomb canned, preserved, jammed, jellied, pickled, and dried enough food stuff to provide about 3 quarts of food per week throughout the year for her family. Considering the long growing season and the short mild winters of Mississippi, this supply was probably great enough to supplement the supply of fresh foods which could have been obtained from the farm.

The Holcombs, however, have a very unsatisfactory garden. Mr. Holcomb excuses himself by saying that it is not worth the work that it takes. We know, of course, that this is not true. A garden with reasonable management is certainly worth what it costs. In fact, one can cite numbers of instances in which very large quantities of vegetables have been produced on small plots of land. Mr. Aser of Choctaw County, has a garden of 1½ acres. Last year it cost him, counting the labor, seed, fertilizer, use of land, and horse work, $47.57. He supplied his family of four with vegetables throughout the year and sold $82.20 worth. Mrs. Holcomb says, "A garden is a good thing but it takes all Mr. Holcomb's time to work his crop." We know that a garden can be cared for at times when the work interferes very little with regular farm or home duties. Mr. Randle has a successful garden. Yet, he gives an average of only thirty minutes a day to its cultivation.

The Holcombs have only three fruit trees. These do not produce sufficient quantities of fruit to last throughout the year. A well planned orchard is as necessary as a well planned garden. Proper care of this orchard is also essential, for production decreases when one neglects pruning and spraying. Fruit is a food, not a knick knack to be eaten between meals. Therefore, it behooves Mrs. Holcomb to provide an adequate supply, which includes preservation as well as production.

This family raised and killed enough hogs to provide lard and salt meat for the greater part of the year, but depended, largely, on the town market for their fresh meat supply. The butcher shop bill might have been saved or, at least, reduced by making greater use of unprofitable

milk cows, calves not needed for dairy purposes, and culls from the poultry flock.

Valued at retail selling price, the foods raised on this farm and eaten by this family were worth around $39.00 a month. However, the question of variety is one of greater importance than that of value. This means that the Holcombs should budget their time among the various food products, allowing a generous share for the garden and orchard.

Food Costs

This family consisted of a father, a mother, a boy 16 years of age, and two girls, 12 and 7 years of age. They consumed about $53.00 worth of food per month, which is equivalent to about 35 cents per man per day.

Money value of foods used by the Holcombs during the first two weeks in November:

Foods Purchased		Foods Furnished by Farm	
Apples	$.35	Blackberries (c)	$.50
Beef	.55	Chicken	.92
Baker's Bread	.30	Eggs	.87
Cabbage	.25	Turnip Greens	.44
Cheese	.35	Lard	1.45
Cornmeal	.74	Whole Milk	10.08
Flour (white)	2.00	Molasses	.71
Sardines	.10	Peaches (c)	.50
Pork	1.25	Peanut Butter	.35
Sugar	.68	Peas (d)	.18
		Pickle	.30
Edible food from this supply fed to animals		Salt Pork	1.04
		Potatoes (Irish)	.30
Buttermilk	2.90	Potatoes (sweet)	1.00
Cornbread	.20	Preserves	.42
		Sausage	.62
		Squirrel	.30
		Tomato (c)	.50
		Turnips	.55

One of the usual methods of valuing home grown products is to use retail selling price in town. This method is used as it gives a good basis for comparing foods purchased with those raised at home. Yet, it results in the money

value of a dietary appearing higher than it really is. In all probability the Holcombs would never have paid $7.18 in cash for milk and milk products, or 50 cents for canned blackberries.

The food supply of this family furnished all food needs with the exception of iron. A more generous use of vegetables and fruits and part of the money used for white flour spent for whole grained foods would have taken care of this deficiency. A little more time in the garden with no more cash expenditure would have given an adequate dietary.

Indeed, it is possible to provide an adequate dietary for much less cash than was expended by Mrs. Holcomb. Mrs. James, for instance, spent only $2.21 in cash during a period of two weeks in November. Yet, her dietary was adequate. She purchased sugar, rice, flour, and grits, and obtained milk, eggs, vegetables, fruits, molasses, meat, and lard from her farm. Filling the market basket is then as much a question of what one produces as it is a question of what one spends.

One may purchase a variety of foods and yet have an inadequate dietary. One may purchase only 2 or 3 foods and yet have an adequate dietary. This fact is brought out by a tabulation of foods purchased in February and in November by Mrs. Gay. In February she raised a quantity of food at home, by November she had moved to town and had to depend on the grocery store.

Foods Purchased by Mrs. Gay in February (2 Weeks)		Foods Purchased by Mrs. Gay in November (2 Weeks)			
Flour	$.64	Meal	$.29	Bread	$.20
Meal	.41	Flour	.70	Eggs	.25
Sugar	.22	Sugar	.54	Turnips	.15
		Cakes	.25	Salmon	.35
		Corn	.40	Salt Pork	1.00
		Lard	.75	Crackers	.20
		Butter	1.20	I. potatoes	.25
		Buttermilk	.80	Beef steak	.40
		Oysters	.65	Pork & beans	.15
		Cheese	.35	Pork	.50

In spite of the small amount of food purchased in

February Mrs. Gay's dietary was more adequate than in November, the month she purchased a large amount.

Rural families raising little food at home rarely get an adequate dietary. In theory it is possible for them to live adequately from paper sacks. In practice those raising little at home are families with too little cash to purchase a sufficient amount and variety of food to supplement the supply raised at home.

Meat and Fish

In the period of two weeks mentioned, the Holcombs consumed only $3.12 worth of meat. This supply included pork, chicken, beef, squirrel, and sardines, a large part of which was purchased.

To supply pork and pork products for the average farm family, at least, one pig should be raised per adult person or equivalent. This would provide around 150 pounds of pork products per adult, enough for the family and a surplus for sale. In addition, the unprofitable milk cows should be turned into beef, calves not needed for dairy and breeding purposes into veal. Such a plan will result in adequate quantities of meat as well as an additional source of income. Because of poor facilities for keeping fresh meat, a large part must, of course, be cured and canned. Families desiring a fresh supply can well follow the community who planned for such a supply by organizing a meat club. The members took turns in providing animals for slaughtering, the different cuts of meat going to the different members in rotation.

The Holcombs or other families living on the farm should not have to depend so largely on the town for their meat supply. Meat can usually be produced on the farm more cheaply than it can be bought in town. Therefore, a plan should be worked out whereby a regular meat supply is assured.

This family did not use meat once a day. Meat is valuable in muscle building, in blood formation, and in stimulating appetite. It is, however, deficient in bone building

materials and in most of the vitamins. Yet, no one food is perfect in every respect. Meat should certainly be included in the family dietary but not too abundantly for excessive quantities are not easily cared for.

Where more meat than is needed is produced, it should be sold, not eaten. Indeed, when cash income is low and meat is produced in abundance, it would often be advisable to sell the more expensive cuts and use the cheaper cuts at home. There is little difference in the nutritive value of the different cuts. The housewife must, however, "adjust palate and purse so that each has its due."

Eggs

During this period of two weeks in November the Holcombs used a little over two dozen eggs, or about one-third of an egg per man per day. In spring and early summer they used more than the standard, an egg per man per day. A flock of 55 fowls should certainly produce an abundant supply of eggs throughout the year. That production is low in fall and winter is partly due to two facts, poor feeding and poor stock. The non-layers should be eaten, canned, or sold. The layers should be fed regularly and well. A surplus produced in fall and winter will bring in much more cash than a surplus in spring.

If Mrs. Holcomb had put away eggs in the spring when they were plentiful for fall and winter when they were scarce, her family would have had an egg per man per day. On the other hand, she could have purchased eggs when production was low. This, she rarely did.

A regular egg supply is important, for eggs are especially valuable in dietaries of children. It is as important in fall and winter when they are 40 and 50 cents a dozen as it is in spring when they are 20 and 25 cents a dozen. Therefore, Mrs. Holcomb should make provision for a regular supply.

Dairy Products

$7.18 or nearly 29 per cent of the total value of the

Holcombs' dietary went for milk and butter. This allowance provided around a gallon of milk a day and butter in generous quantities. Cheese was the only dairy product which was purchased. However, only 35 cents was paid for cheese. It is well that milk was so generously provided on this farm.

The secret of an adequate and cheap diet is plenty of milk. Milk is our cheapest source of muscle and bone building material. It is almost impossible to get sufficient quantities of bone building material without using milk. One authority says, "spend as much for milk as for meat, fish, and poultry." The milk and butter used by the Holcombs were worth more than twice as much as the meat they used.

Why is it important what this family or that spends for this food or that? Simply because expenditures among the various food groups affect the food value of a diet. A large percent of total expenditures for milk means a diet that is adequate in most of the nutritive factors.

Fats

The lard, salt pork, and sausage used during a period of two weeks by the Holcombs amounted to $3.11 or 12 per cent of the total money value of their dietary. In addition, there was butter for which we have no figures. This means that the amount of fat used provided more than the general allowance of three-fourths of a pound a week for adults and six ounces a week for children under ten years of age.

The quantity of fat used was largely due to habits of cooking and eating, partly due to the fact that farm families require more fuel foods than do families doing less strenuous work. It is probable that this family would have been better off from a health as well as a financial standpoint had they sold a part of this fat supply.

Grain Products

The Holcombs used only three foods from this group:

white flour, cornmeal, and baker's bread. All three of these foods were purchased. Flour was, however, used in larger quantities than was cornmeal. Very little baker's bread was used.

These three foods are among the lower priced cereals or grain products. For instance, a package of four ounces of ready-to-eat cereal may be obtained for 15 cents or one pound for 60 cents. A pound of cornmeal may be obtained for a little over 3 cents. Yet, they yield about the same amount of fuel.

Cereals furnish more fuel for amount expended than do any other class of foods. In this dietary they furnished one-third of the fuel for one-tenth of the money value.

A high cereal diet means a cheap diet but why should this family live on a diet similar in a number of respects to that of Mrs. Jones from the city? The Holcombs can more easily afford from the standpoint of health and finances to put labor into raising vegetables than they can to put cash into purchasing cereals. More starchy vegetables and less flour could have been used. This would have meant a dietary which provided a greater margin of safety, a dietary with less cash expenditure.

Whole grained cereals are especially important in diets where cereals constitute more than one-fourth of the fuel as did Mrs. Holcomb's. Therefore, it is a pity that unbolted meal, a cheap and easily obtained whole grained cereal, was not used. Whole wheat flour and oatmeal are also cheap whole grained cereals. The use of such cereals at least once a day would mean a better diet, but not a more expensive diet.

Sweets

Sweets are also fuel foods. They owe their popularity to flavor. They furnished 13 per cent of the total fuel value of the Holcombs' dietary for 7 per cent of the total money value. This means that they are cheap sources of fuel. Sweets should not be used too freely in the diet. Too many cause digestive disturbances as well as create an ap-

petite for themselves rather than for other foods. 10 to 12 percent of the total fuel value of the diet from sweets, is a good rule to follow. The Holcombs' dietary furnished a little over this requirement.

Sugar, molasses, and preserves were the only sweets used. Around one-third of the sweet supply was purchased, the rest produced on the farm. Sugar is solely a fuel food, whereas molasses is a concentrated vegetable juice yielding bone and blood building material as well as fuel. Therefore, it is well that molasses was as generously used as sugar.

Preserves contain about two-thirds as much mineral as does the corresponding fruit. As previously stated, food produced on the farm was priced at average retail selling price in nearest town. Thus priced, preserves were a costly fuel. The food value obtained from preserves, jams, and jellies does not justify an excessive use in the diet. Used moderately as by the Holcombs, they have a distinct place in the family dietary, that of giving variety.

Vegetables and Fruits

Increasing the use of vegetables and fruits would have improved the food value of the Holcombs' diet in every point needing improvement. Vegetables and fruits rank next to grain products and milk in the formation of an economical and well-balanced diet.

Over three-fourths of the vegetables and fruits used were produced on the farm. This means that Mrs. Holcomb purchased very few of these foods. Fresh vegetables such as cabbage, lettuce, collards, turnips, beets, carrots, butterbeans, spinach, etc., can easily be grown in the month of November. However, only one or two fresh fruits are available at this time. For this reason, a well planned Mississippi dietary will always provide for the purchase of some fresh fruit at this season.

An increase in the use of green vegetables which are rich in iron and an increase in the use of raw vegetables and fruits which are rich in vitamin C would have meant

a better diet for the Holcombs. Such a diet could have been obtained without greatly increasing cash expenditure for food.

Getting Better Values

As previously stated, Mrs. Holcomb purchased the following foods: apples, beef, baker's bread, cabbage, cheese, cornmeal, flour, sardines, pork, and sugar.

This study came just before hog killing time and when egg production was low. Provision for such a time, as canned beef, culls from the poultry flock, or preserved eggs would have saved buying meat. Having made no such provision, Mrs. Holcomb did right in purchasing a supply, for meat has a place in the family dietary.

Cabbage was purchased which could have been produced on the farm. Chemical analyses have shown that the green cabbage usually found in the farm garden in richer in iron than the white cabbage which one generally buys.

American cheese as well as cottage cheese can be made successfully on the farm. During certain seasons, Mrs. Holcomb has an over supply of milk. Yet, she can find no market for this surplus of only a few weeks. A yearly supply of American cheese could easily be made at such a time at practically no cost except that of labor.

$2.00 was a large proportion of total expenditures for a food which adds so few food factors as does white flour. Satisfactory quantities might have been purchased for 75 cents. 50 cents of the amount saved could have been used in purchasing whole wheat flour, 25 cents oatmeal. This would have meant a better as well as a cheaper diet.

Perhaps, the same amount of cornmeal could not have been produced much cheaper on the farm. The same amount of cornmeal produced on the farm would, however, have given more food value, for much food value is lost when the bran and germ of the grain are removed.

In this State, it is possible to produce fruit only seven months in the year. The varieties most easily grown are

not those which will keep for several months. Storage facilities are generally poor. Therefore, for five months in the year one must largely depend on canned and dried fruit. The Food Habits Score Card of the Extension Division calls for fruit twice a day, one of which must be raw fruit or canned tomatoes. In order to meet the fruit requirement during the five months mentioned enough fruit should be canned or dried to serve fruit once a day, enough bought to serve fresh fruit at least three times a week.

Therefore, Mrs. Holcomb is to be considered wise rather than extravagant in purchasing apples for her family. Indeed, tripling her expenditure for fresh fruit would have been justified.

The only foods which should be needed to supplement home products are cereals, sugar, and fresh fruits (for a few months in the year). This involves only a small cash expenditure.

When families fail to take advantage of their land, it means either of one or two things, doing without or purchasing extra supplies. The first course is usually followed, for cash realized from the average farm is not great. Yet, it is better to purchase what the purse can ill afford than it is to do without what the body needs.

Table Waste

By table waste, is meant food not eaten. It may include plate scraps or edible food uneaten.

The percent of plate scraps varies from little or nothing to 20 per cent of the value of the dietary. Plate scraps amounted to 10 per cent of the value of the Holcombs' dietary. Better cooking, and serving to suit the demands of the individual appetite, would have meant a smaller amount left on the plates.

Mrs. Holcomb, by cooking food in amounts likely to be eaten and using leftovers at a later meal, kept down waste of edible food to the minimum. In two weeks time, there was only $3.10 worth of edible food not needed for human consumption. This was fed to chickens and hogs as were

plate scraps.

Table waste as long as it is composed of comparatively cheap foods makes suitable feed for animals. Foods like cornbread and buttermilk make healthy animals as well as healthy children. Therefore, the question of reducing table waste to the minimum is not so important to the farm woman who has productive animals to feed.

Food Value and Money Value

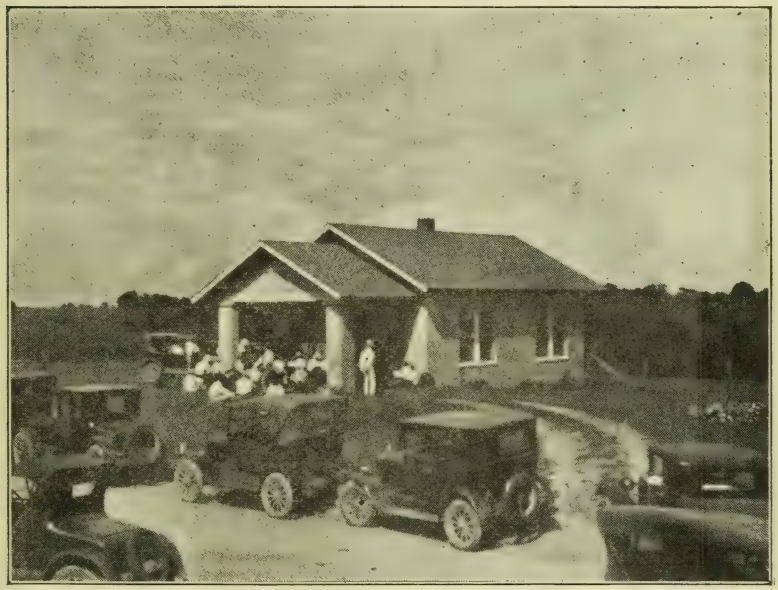
Low, moderate, or high cost dietaries can be planned but after all the most important thing for the rural housewife who secures a large part of her food without cash outlay is a dietary which is both adequate and palatable, one that meets the individual needs of her family.

A knowledge of food values combined with a generous supply of home raised products would make it possible for Mrs. Holcomb as well as other housewives to fill their market baskets adequately and cheaply.

Bulletin No. 264 December, 1928

REPORT OF HOLLY SPRINGS BRANCH EXPERIMENT STATION, 1928.

By C. T. Ames and Otis B. Casanova.



Station Office

Mississippi Agricultural Experiment Station
A. and M. College, Mississippi.
J. R. Ricks, Director.

REPORT OF HOLLY SPRINGS BRANCH EXPERIMENT STATION, 1928.

The work of the Holly Springs Branch Station has been conducted along the lines towards the development of successful and progressive agriculture for this section of the state. While this station is located only about twenty miles south of the Tennessee line, the soils are very similar for more than two hundred miles south of this place. Results obtained from cooperative experiments with fertilizers conducted for a number of years over the northern hill section of the state indicates very similar soil requirements. More work has been done this season than any time within the past history of the station. The effect of the work done here can be seen on many farms in the state in the use of fertilizers, varieties of farm crops, spacing of cotton, cultural methods of farm crops and in dairying and other farm work. The seasons the past year were unfavorable for all farm crops due to too much rain during the early Spring and Summer and then followed by extreme dry weather in the fall.

The results of these unfavorable growing seasons can be seen in the low yields of cotton, corn, hays, pastures, grasses, sweet potato and other farm crops over a greater part of the hill section of the state.

Additional Land Purchase—The Mississippi Legislature at the regular Session of 1928 appropriated $8000.00 for the purchase of additional lands for station purposes. At this writing 188.4 acres of thin but very uniform land has been purchased. This land is slightly rolling with ½-mile frontage on a state highway; and within operating distance from the station. As much of this land will be used for experiment work next year as the support fund will allow. This will remove one of the greatest handicaps of the station. Land of uniform fertility whether rich or poor is necessary to secure reliable results in any form of experiment work. In the past our experiment fields have of a ne-

cessity been located here and there over the farm, the size of each field being determined only by the amount of land suited for experiment work. It has in the past been necessary to rent suitable land in two directions from the station in order to secure enough for experiment work.

Insect and Disease Damage—The boll weevil did considerable damage to the cotton crop in this section the past year. The red spider, cotton hopper, plant lice, rust, cotton wilt, and pink boll rot (anthracnose) all played a part in reducing the yield of cotton. The cotton hopper did less damage than usual. An unusual large number of boll weevils went into winter quarters in the fall of 1927. The extreme cold weather during the winter killed many of these weevils in this section so that the emergence the past spring was below normal. The wet spring weather favored rapid development of the weevil, which were finally brought under control by hot, dry weather. Far less weevils went into hybernation this fall than in 1927. The growing season for cotton was from two to three weeks later than usual this year. The cotton crop will about equal that of the year 1927. The corn and hay crops are very short this year in this section of the state.

Drainage—The controlling of the surface water especially on the cultivated lands of the South is of first importance. The growing of legumes and the use of farm manures will avail but little if the soils are allowed to wash with heavy rains. After fencing the farm the first work should be to control surface water on all lands that are clean cultivated. In many instances it will pay to terrace the pasture lands. County agents are ready to assist at all times in this work. Hill soils will rapidly decrease in fertility when cultivated, regardless of the care used in running off the rows, if terraces with a slight fall are not used to conduct the excessive water slowly to the main drain during heavy rains. This work is inexpensive if done at the proper time and should supersede all other farm work. The cost of terracing an acre of land before it is badly broken is not more than one dollar per acre for the labor, if the labor is to be hired to do the work. If the work is to be done by the landlord, the cost will be about one day's work per man for each acre terraced. Any land in the

state can be terraced between the time the crops are gathered in the fall and the time to plant the next crop in the spring with the labor and teams used in cultivating the land.

Soil Improvement—The soils on the station farm were very thin and in a badly eroded condition when they were deeded to the state to be used as an experiment station. If every land owner or farmer in the state had gone through with what it means to try to redeem poor washed gullied lands and bring them back to where they are fairly productive, no time would now be lost in seeing that every acre grew either a summer or winter legume each year. This class of work is awaiting most of the farms of the state today. There is far more profit in the type of farming when soil fertility is maintained than there is in the system of digging every dollar out of the land that can be had and returning nothing to the soil year after year. One ton of legume hay of almost any kind turned into the soil would add about $12.00 worth of nitrogen and about the same money value in organic matter. On the station farm soy beans are grown in all plantings of corn and either winter vetch, crimson clover, or Austrian winter peas are grown with small grain in all cotton middles and after hay crops. It is not the best method for any man to try to remove the soy bean hay that is grown in corn. Graze the crop after removing the corn or turn it under to improve the soil. The solution of one of the greatest farm problems today lies in rich fertile soils that will grow almost any kind of crop. When land improperly cultivated gets too thin for growing corn profitably, fertilizers are used and the land planted to cotton. The introduction of livestock, preferably the dairy cow in most instances, would aid greatly in the solution of farm problems.

Special attention has been given to the use of fertilizers under cotton, corn, sweet potatoes, and other crops, also a cotton spacing test, varieties of cotton, corn, sweet potatoes, sorghum, lespedeza, vetch, soy beans, fruits, pecans, grapes and other crops. Fertilizer tests with alfalfa, including both spring and fall plantings have also been made. Dairying, poultry and pasture making have had their places in the year's work. All calls for institute work were filled.

COTTON

One of the most prominent cotton growers of the South has said the way to grow cotton is to plant on rich land and keep the grass out of it. To be a little more explicit,—the requirements for growing cotton successfully are: a fertile soil, the judicious use of fertilizer, proper cultural methods adapted to the several cotton growing sections and insect control. Never within the past history of the South has the public been in a more receptive mood to use improved methods as can be seen in increased crop yields. The tendency now is to replace labor to a great extent with improved farm machinery. Two and four row cultivators operated by one man are attracting much attention in sections where such machinery can be worked to advantage. More cotton per acre at less cost is vital to the industry.

Hill or rolling land should not be broken in the fall unless seeded to a winter cover crop of some kind. When a cover crop is not to be planted, it is advisable to leave all of the vegetable matter on the surface during the winter to check soil washing during heavy rains. Sod land should be turned in the fall and kept rough. A disk harrow will put this land in excellent condition, the following spring. Valley land may be broken in the fall if the surface water is properly controlled. Deep plowing on hill sides in the fall will not prevent soil washing in this section. A winter cover crop planted in cotton middles in late September gives the best protection for all kinds of land during the winter months. Livestock such as sheep, beef cattle or the dairy cow can be grazed on such crops when the condition of the soil will permit. This method will add greatly to the pasture grazing season.

Preparation of Land—There are several ways land may be prepared for cotton in this section. One way is to run a furrow down the water furrow of the old rows and throw two furrows together on this furrow, or list the land. Where this method is practiced the fertilizer should be applied in or on this list about ten days or two weeks before planting time. Then break the middles out with a buster and allow the land to remain in this condition until planting time. At planting time harrow down to slightly elevat-

ed rows ahead of the planter. This method is very satisfactory when the rows are not to be changed and most of the work is to be done with small plows.

A second method is to break the land broadcast in the spring. About two weeks before planting time, lay off the rows and apply the fertilizer, which may be done with the same machine. The row is completed by throwing out the middles with a buster. Harrow and plant as given above. The only objection we find to this method is that land flat broken in the spring may remain too wet to plow longer an unfavorable spring and delay planting.

The third way suggested is to put the land in rows at any time before planting time, harrow down and apply the fertilizer in the top of the row about three inches below the surface, cover with a harrow and allow to remain until planting time.

The method used on the station is a little different from any suggested on account of having to use the same plots year after year in experiment work. The old row is split open with a middle breaker, a shovel plow is run in the bottom of this buster furrow and the land listed on this furrow with a single horse plow. This method puts the row in the same position of the old row. Fertilizer is applied in this list and the row completed with a middle breaker. When very heavy applications of fertilizer are used the fertilizer is mixed with the soil by running a shovel plow furrow before the middles are broken out. A section harrow prepares the land ahead of the planter.

We have never had ill effect with fertilizers even when as high as one ton or more is used per acre when the above method is used. Fertilizer applied about three inches below the seed gives satisfactory results.

An ideal seed bed is one prepared and fertilized two weeks before seed planting time and settled by a rain. In practice it is frequently the case that preparation, fertilization, and planting is, of a necessity, done at very short intervals.

Cotton Planting Time—In this latitude the time to plant cotton is usually between April 25th and May 10th. Cotton should be planted when the ground is warm enough to cause quick germination. A good stand and earliness are

very great factors in the amount produced. It is better to plant medium early and secure a good stand than to plant early and get a poor stand. One of the cheapest and best ways to increase the yield of cotton per acre is to get a good stand of cotton. One of the ways to get a good stand is to plant enough seed.

A good stand on hill land is from three to four stalks in bunches per foot. A good stand on valley land is two to three stalks in bunches per foot.

A properly balanced fertilizer is necessary to secure the best results with the above spacing. From our past results, with the exception of this year's results, blocking the cotton and having the blocks about twelve inches apart is not far from good spacing.

Depth of Planting—Cotton seed should be planted very shallow in a medium elevated row. It is advisable to use from one and one-half to two bushels of seed per acre, or use the hill dropper. The eariler the planting is made the more seed should be used. A good practice is to run the planter twice down each row using half the quantity of seed each way. The first trip will plant the seed a little deeper than the second. A good stand is the most important factor in growing cotton.

Cultivation—As soon as the plants are established sufficiently not to be injured, cultivation should begin. We find a side harrow does splendid work for first cultivation. The Rotary hoe gives promise of a most valued tool. Some use the section harrow to advantage. Others use the double cultivator. Regardless of the method used, thin or block the cotton as soon as possible and give shallow, frequent cultivation.

We find it a good practice to cultivate as soon as possible after each rain but if the rains are far apart, it may be necessary to cultivate more often,—something like once every ten days or two weeks.

Boll Weevil Control—If any weevils can be found just as the first squares are about half grown, calcium arsenate should be applied in the bud of the cotton in any form desired by the operator. The past two years have convinced us that this is the correct method. Use either calcium arsenate dust or the sweet poison. (The association of

Southern Agriculturalist suggest the finding of twenty weevils per acre before poison is used.) A second application about ten days later should be made if any weevils can be found.

Results from this station indicate that in this latitude this second application is usually due about the time most of the weevils are out of hibernation, which means most of the weevils are destroyed. Should the weevils become plentiful later in the season, poisoning should begin with calcium arsenate dust as soon as 10 per cent squares infestation is found. Mr. B. R. Coad of the U. S. Department of insect control, recommends three applications four days apart, beginning with about 10 per cent infestation. After the three applications, the weevils should be held down to about 20 per cent infestation by later dustings.

Rust—Some times known as Poatsh hunger. According to Dr. D. C. Neal, Plant Pathologist, Mississippi Experiment Station in bulletin No. 248, "The Most Common Causes of rust are the lack of humus or vegetable matter in the soil, lack of potash, and lack of drainage." He recommends for the control of rust a system of rotation that will build up the humus or vegetable matter, or the use of farm manures. Kainit at the rate of 200 pounds per acre or muriate of potash 50 pounds per acre, or potash in other forms used as a fertilizer gives good results. In our results at this station it appears that a complete fertilizer containing a high percent of potash such as 8-4-6 and 8-4-8 used at the rate of 600 pounds per acre gives splendid results. See four year average, table No. 5.

Wilt—Cotton wilt and rust are often confounded. Rust appears to be unsatisfactory soil condition, whereas wilt is a disease. Quite frequently both wilt and rust are found together in the same field. Cotton wilt is doing untold damage on many farms. Symptoms,—according to Dr. D. C. Neal, "cotton wilt may be suspected when plants wilt and die without any apparent reason. Such plants are usually stunted early in the season as compared with healthy plants and the leaves turn yellow at their margins and between the veins. The chief symptom of a plant infected with wilt is the characteristic internal appearance of effected stalks. If the stem of a freshly wilted plant is cut across

near the ground and the tissue in the region of the water—conducting vessel shows brown or blackened area, there is strong evidence of the disease."

Control of Wilt—Plant wilt resistant varieties of cotton according to Mississippi Bulletin No. 248 by Dr. Neal, the following varieties are the most promising wilt resistant: Staple cotton—Super Seven, Lightening Express, Watson, and D. and P. L. No. 6. The most promising wilt resistant short cottons as indicated from these tests are Thyne's Cook, Dixie Triumph, Miller, and Cleveland 54. Wilt is not transmitted by the seed. The disease is in the soil and it requires eight or more years to free the land from the disease even when no cotton is grown on the land during this period.

Pink Boll Rot—Anthracnose. This disease is widely known over the entire cotton growing area. It was very prevalent in this section during this year. Under favorable weather conditions the disease may effect young plants. The final stages are bolls with gray to brown water-soaked spots, which later enlarge, becoming redish-brown in color, finally destroying the boll.

Causes—A fungus disease which may live over winter on diseased plants and infect the following crop. The disease is also transmitted by infected seed.

Control—Plant some other crop on the infected land the following year. Plant disease free seed on clean land. The planting of two year old seed is recommended. Rotation is good for the land as well as for the cotton. Such varieties as Cook and Half and Half are rather susceptible to the disease.

Variety Test—Two variety tests were made, one on valley land and one on hill land. The soil used in the valley land test was improved brown loam. The hill test was on brown loam table land of ordinary fertility. Each variety was planted in one row plots and repeated four times. The rows in the valley test were 108 feet long and on hill test 200 feet long. Twenty nine varieties were used in each test. Poor stands were secured on Miss'dell No. 1 and No. 2. Miss'del No. 2 was discarded from the test on account of failure to secure a stand.

Plantings were made April 25th and 26th. Some va-

rieties were replanted with a hoe May 14th. The seasons were very unfavorable up to this time for cotton.

Fertilizers—The valley variety test was fertilized with 840 pounds per acre of 8-4-4 home mixed fertilizer.

The hill test was fertilized with 760 pounds of the same mixture.

Two series of both valley and hill land tests had heavy additional applications of potash. Two hundred pounds per acre of muriate of potash were added by hand ahead of the fertilizer distributor to series 1 and 3 of the valley land

Table 1.—Cotton Variety Test, Valley Land

Variety	Pounds per Acre		Lint Data		Value			Per Ct.
	Seed cot.	Lint	Per Cent	Leng-th	Cents per lb	Per acre	RANK	Seed cot. 1st. pick
Cleve. 54	2148.0	704.5	32.8	15-16 f	18.20	154.20	4	49.5
Cleve. 884	1528.1	504.3	33.0	1 1-32	19.05	114.50	28	50.2
Cleve Wilson	1702.3	529.4	31.1	7-8 f	17.70	114.81	27	55.1
Cleve. Piedm't	1769.3	559.1	31.6	7-8 f	17.70	120.74	26	51.1
H. & H., Mahon	1735.8	642.3	37.0	13-16f	17.20	130.16	20	44.1
Cook 1010	1705.7	644.8	37.8	13-16f	17.20	130.00	21	51.3
Acala 37	1799.5	583.0	32.4	1 1-32	19.05	132.96	16	45.3
D. & P. L. 8	1799.5	674.8	37.5	1	18.45	144.74	6	58.7
Rowden 40	1866.5	604.7	32.4	1	18.45	134.28	14	48.5
Miller	2003.9	623.2	31.1	1 1-32	19.05	143.57	8	50.8
D. & P. L. 4	1883.3	638.4	33.9	1	18.45	140.19	11	48.9
Deltatype Web.	1745.9	536.0	30.7	1 3-16	20.60	132.20	17	52.8
Delfos 910	1890.0	565.9	30.1	1 1-8	19.80	135.88	13	46.8
Missdel 1	1561.6	509.1	32.6	1 5-32	20.00	120.77	25	39.9
Delfos 911	2245.2	698.3	30.1	1 5-32	20.00	167.50	1	40.5
Delfos 6102	2017.3	607.2	30.1	1 3-32	19.65	144.69	7	50.2
D. & P. L. 6	1688.9	569.2	33.7	1 3-32	19.65	132.00	18	44.2
Express 121	1946.9	626.9	32.2	1 3-32	19.65	146.95	5	48.7
Lone Star 168	1846.4	600.1	32.5	1 3-32	19.65	140.35	10	40.1
Lone Star 284	1705.7	581.6	34.1	1 1-16	19.40	133.06	15	32.4
Lone Star 65	1890.0	606.7	32.1	1 1-16	19.40	140.80	9	36.9
Miss. Sta. Trice	1732.5	521.5	30.1	1 1-32	19.65	124.27	24	28.3
Trice 322	1631.9	538.5	33.0	1 1-32	19.65	125.50	22	18.7
Rowden 2119	1745.9	563.9	32.3	1	18.45	125.32	23	52.2
Rowden 3053	2134.6	706.6	33.1	1	18.45	156.07	3	47.6
Express 116	1883.3	585.7	31.1	1 3-32	19.65	138.45	12	41.5
Stoneville 1	1709.0	562.3	32.9	1 3-32	19.65	131.13	19	38.6
Stoneville 2	2057.5	685.1	33.3	1 3-32	19.65	159.32	2	34.2

test and the same amount was added to series 2 and 4 of the hill land test. The results were as follows: on valley land, series 1 and 3, yield of seed cotton per acre, 2047.3; on series 2 and 4 where no additional potash was used, 1592.6.

The difference of 454.7 pounds of seed cotton per acre is the increase from the additional amount of potash used. We feel sure a smaller amount of potash would have given equally as good results. This land produced 27.2 tons of sorghum silage in 1927. Vetch hay was also removed nearly every other year for the past fifteen years.

Table 2.—Cotton Variety Test, Hill Land

Variety	Pounds per Acre		Lint Data		Value		RANK	Per Ct.
	Seed cot.	Lint	Per Cent	Length	Cents per lb	Per acre		Seed cot. 1st. pick
Cleve. 54	939.7	355.2	37.8	15-16	17.95	74.28	20	88.2
Cleve. 884	857.6	313.0	36.5	1	18.45	67.55	23	61.1
Cleve. Wilson	1043.5	374.6	35.9	13-16f	17.20	76.47	16	72.7
Cleve. Piedm't.	894.5	329.2	36.8	13-16f	17.20	66.80	24	72.5
H. & H. Mahon	998.3	434.3	43.5	3-4f	17.20	84.85	5	77.5
Cook 1010	887.8	380.0	42.8	13-16	17.20	74.50	19	77.5
Acala 37	973.2	346.5	35.6	1	18.45	75.21	17	74.0
D. & P. L. 8	802.3	333.8	41.6	15-16	17.95	68.35	22	57.8
Rowden 40	1095.5	399.9	36.5	15-16f	18.20	85.30	3	67.1
Miller	1016.7	370.1	36.4	1	18.45	79.92	12	68.4
D. & P. L. 4	996.6	388.7	39.0	15-16	17.95	80.71	11	73.3
Deltatype Web.	824.1	281.0	34.1	1 1-8	19.80	65.42	26	75.2
Delfos 910	966.5	336.3	34.8	1 3-32	19.65	77.42	13	66.7
Missdel 1	773.9	280.9	36.3	1 1-16	19.40	63.36	27	63.0
Delfos 911	1149.1	401.0	34.9	1 3-32	19.65	92.27	2	69.8
Delfos 6102	959.8	341.7	35.6	1 1-16	19.40	77.42	13	60.9
D. & P. L. 6	820.8	320.1	39.0	1 1-32	19.05	60.98	28	55.7
Express 121	1031.8	381.8	37.0	1 1-32	19.05	84.43	7	69.6
Lone Star 168	973.2	360.1	37.0	1 1-16	19.40	80.90	10	78.1
Lone Star 284	1051.9	382.9	36.4	1 1-32	19.05	84.98	4	78.7
Lone Star 65	922.9	330.4	35.8	1 1-16	19.40	74.77	18	75.3
Miss. Sta. Trice	991.6	340.1	34.3	1 1-32	19.05	76.52	15	83.8
Trice 322	924.6	339.3	36.7	1	18.45	73.14	21	91.1
Rowden 2119	844.2	309.8	36.7	15-16f	18.20	66.00	25	67.5
Rowden 3053	1070.3	398.2	37.2	15-16f	18.20	84.57	6	65.6
Express 116	1062.0	370.6	34.9	1 1-32	19.05	83.05	9	76.0
Stoneville 1	1021.8	381.1	37.3	1 1-32	19.05	84.13	8	66.9
Stoneville 2	1185.9	454.2	38.3	1	18.45	96.97	1	81.8

COTTON VARIETY TEST, SIX YEAR AVERAGE

There is no doubt but that the careful selection of varieties of cotton to meet existing conditions, and the judicious use of the proper fertilizer, will add to the profit of the growers more than anything else under their control. There is a great need of a change in the basis of production from the planting of mixed "Gin-run" seed to the planting of uniform select varieties.

There are but few real cotton markets in this section for the above reasons. Under the usual local marketing conditions there is very little inducement to the grower using improved varieties because the price paid for this improved cotton is about the same as that paid for cotton from mixed Gin-run seed. The cotton buyer takes the profit in place of the grower. The only remedy suggested is to organize Community Cotton Growers Clubs and limit its members to one standard variety.

In as much as the mixing occurs principally at the gins, it will be necessary for these Community Clubs to control the gin or gins to prevent this mixing of seed. Such communities will find a ready demand for all cotton grown at one to two cents premium per pound above the average cotton prices. The only other method that we can suggest is to use proper care in cleaning the Gin in order to secure pure seed for planting purposes. The lint should be sold through standard cotton markets.

Table 3.—Cotton Variety Test 6 Year Average

Variety	Valley		Hill	
	Lint Yield	Value Lint and Seed	Lint Yield	Value Lint and Seed
Delfos 6102	554.8	148.92	419.8	107.0
Delfos 631*	516.6	147.61	400.3	113.26
Lone Star 65	586.3	143.89	432.7	101.40
Miss. Sta. Trice	536.0	134.67	413.9	98.41
Willis*	585.5	131.30	452.5	104.06
Deltatype Webber	449.9	130.08	316.1	90.82
Cleve. Wann.*	496.6	129.15	401.9	86.04
Express, Light.*	359.5	129.15	387.1	106.12
D. & P. L. 4	618.5	127.14	480.0	107.40
Cleve. 54	545.7	128.85	402.1	90.41
Half and Half Mahon	590.2	123.99	471.2	98.48
Miller	561.4	123.45	393.6	93.70
Acala 5*	541.7	119.04	435.2	104.18
Cleve. Pied	507.0	111.84	378.5	84.01

* Five Year's Average.

In the six year average table submitted above there are several varieties to which we wish to call special attention. Short staple varieties, D. and P. L. No. 4, Lone Star 65, Acala No. 5 Cleveland 54, Miler, and for staple varieties, Delfos 631, Lightening Express and D. and P. L. No. 6. We also wish to call attention to some varieties of promise that have been recently introduced. See table under variety tests, 1928. Stoneville No. 1 and No. 2, Rowden 3053.

Cotton Spacing Test—The soil for the hill test was brown loam and for the valley land test it was fertile brown loam land. All plots were fertilized as were the variety tests.

Plots—On hill land, four rows each duplicated, rows 316x3½ feet. On valley land the plots were three rows each duplicated, rows 196x3½ feet. Lone Star 65 cotton was used and plantings were made April 25th and 26th.

An attempt was made to get the following spacing. Cotton, as the planter left it or unthinned, three stalks per foot, two stalks per foot, one stalk per foot, one stalk per 18 inches, one stalk per 24 inches. The following table gives the results on both hill and valley land.

Table 4.—Average Three and Four Year Spacing Test

Hill Land Test 1925-26-27		Valley Land Test 1924-25-26-27	
Stalks per foot in drill.	Yield of seed cotton per acre.	Stalks per foot in drill.	Yield of seed cotton per acre.
4.56	1471.3	4.69	1889.9
2.63	1371.0	2.73	1687.2
1.88	1340.8	2.01	1640.9
1.20	1319.1	1.22	1611.9
.78	1239.0	.85	1408.0
.60	1113.2	.62	1401.5

This season was very unfavorable for the best development of cotton. On the valley land plots the red spider and rust did considerable damage. Probably the lack of moisture was the controlling factor. Our spacing results in 1927 were somewhat similar to this year's results. Both years the growing seasons were somewhat alike, being an extremely wet spring followed by a very dry fall. In a normal season, close spacing gives very much better results than wide spacing. Years like this, close spacing makes equally as much cotton, therefore it is the safest policy to use the close spacing method.

COOPERATIVE FERTILIZER TESTS

This work was conducted by the Holly Springs Branch Station in cooperation with county agents and good farmers. Similar plantings were made on the station on both valley and hill land. Two tests were conducted this year, one on the farm near Torrance in Grenada County, the other test was made near Sardis in Panola County. The planting near Torrance had to be discarded as part of the plots were plowed up and replanted, giving two dates of planting. Mr. C. G. Wallace, County Agent in Panola County, assisted. The plots were located on the farm of Mr. J. S. Woods on the State Highway between Sardis and Batesville. The soil was level second bottom greyish Pebly loam. The variety of cotton planted on this test was D. and P. L. No. 4. In all co-operative work of this station the soil is selected and the fertilizer applied and the crop gathered under the station supervision. The

crop cultivation is under farm management. The variety of cotton used on the Station valley land test was Delfos 1341; on the hill land test Lone Star 65.

In all fertilizer work represented in this bulletin the increase was obtained according to the standard adopted by the American Society of Agronomy as reported in Vol. 16 No. 1 of the Journal. The column marked "check yield" was obtained according to the above method by assuming that there is a gradual increase or decrease in fertility from one check to the other. All plots are 1-20 acre each in size, composed of four rows and three series. Only the middle rows were used in computing yields.

Table 5.—Fertilizer Test Valley Land, Holly Springs

Lbs. of material applied per acre			Average 1925-26-27-28					1928	
			Lbs. of seed cot. per acre			Dollars per acre			
Super phosphate	Nitrate of soda	Muriate of potash	Analysis	Plot yield	Increase	Cost of fertilizer	Net gain	Seed Cotton Increase	Dollars net gain
No fertilizer				1090.6					
300	160	100	8-4-8	1726.0	631.7	9.32	28.67	811.5	40.18
300	160	75	8-4-6	1636.8	538.8	8.63	23.70	816.5	41.01
300	160	50	8-4-4	1592.3	490.6	8.02	21.42	594.9	28.23
No fertilizer				1105.3					
300	160	25	8-4-2	1397.4	295.0	7.42	10.28	269.5	9.24
300	160	....	8-4-0	1252.7	153.4	6.81	2.39	60.6	-2.78
300	320	50	8-8-4	1494.3	398.1	12.39	11.50	458.2	15.87
No fertilizer				1093.1					
300	240	50	8-6-4	1589.7	493.0	10.19	19.39	596.5	26.25
225	160	50	6-4-4	1515.5	415.3	7.41	17.51	533.1	25.09
150	160	50	4-4-4	1448.9	345.2	6.79	13.92	392.5	17.22
No fertilizer				1107.2					
600	320	100	8-4-4	1777.3	676.2	16.04	24.53	760.1	30.69
900	480	150	8-4-4	1753.4	658.4	24.06	15.44	893.7	31.24
1200	640	200	8-4-4	1769.3	680.4	32.08	8.74	1080.7	35.00
No fertilizer				1082.9					

Table 6.—Fertilizer Test, Hill land—Holly Springs

Lbs. of material applied per acre			Average 1925-26-27-28					1928	
			Lbs. of seed cot. per acre			Dollars per acre			
Super phosphate	Nitrate of soda	Muriate of potash	Analysis	Plot yield	Increase	Cost of fertilizer	Net gain	Seed Cotton Increase	Dollars net gain
No fertilizer				508.6					
300	160	100	8-4-8	1167.9	628.1	9.23	28.46	388.3	14.79
300	160	75	8-4-6	1248.9	677.9	8.63	32.04	414.3	16.88
300	160	50	8-4-4	1239.9	637.7	8.02	30.24	327.8	12.21
No fertilizer				633.3					
300	160	25	8-4-2	1126.5	461.0	7.42	20.24	310.2	11.68
300	160	....	8-4-0	1070.0	372.3	6.81	15.53	199.8	5.58
300	320	50	8-8-4	1330.0	600.1	12.39	23.62	314.3	7.24
No fertilizer				762.1					
300	240	50	8-6-4	1167.3	428.3	10.19	15.51	302.9	8.63
225	160	50	6-4-4	1127.7	411.9	7.41	17.30	235.3	7.22
150	160	50	4-4-4	1049.7	357.1	6.79	14.64	219.7	6.85
No fertilizer				669.4					
600	320	100	8-4-4	1322.9	675.7	16.04	24.50	494.6	14.76
900	480	150	8-4-4	1434.6	809.8	24.06	24.53	495.6	7.36
1200	640	200	8-4-4	1479.5	877.1	32.08	20.55	542.4	2.70
No fertilizer				580.0					

Table 7.—Cooperative Fertilizer Test, Panola County

Pounds of material applied per acre.				Pounds of seed cotton per acre.		Dollars per acre.			
Super-phosphate	Nitrate of soda	Muriate of potash	Anly-sis	Plot yield	Check yield	Increase	Increase at 6c	Cost of fertilizer	Net Gain
No fertilizer				630.5	630.5				
300	160	100	8-4-8	1123.7	673.1	450.6	27.04	8.51	18.53
300	160	75	8-4-6	974.4	715.7	258.7	15.52	7.98	7.54
300	160	50	8-4-4	1006.4	758.3	248.1	14.89	7.46	7.43
No fertilizer				801.1	801.1				
300	160	25	8-4-2	1101.1	800.7	300.4	18.02	6.93	11.09
300	160	....	8-4-0	1073.1	800.4	272.7	16.36	6.41	9.95
300	320	50	8-8-4	1209.0	800.1	408.9	24.53	11.62	12.91
No fertilizer				799.8	799.8				
300	240	50	8-6-4	1186.4	793.2	393.2	23.59	9.54	14.05
225	160	50	6-4-4	1090.4	786.5	303.9	18.23	6.90	11.33
150	160	50	4-4-4	1049.1	779.8	269.3	16.16	6.33	9.83
No fertilizer				773.1	773.1				
600	320	100	8-4-4	1274.3	754.5	519.8	31.19	14.92	16.27
900	480	150	8-4-4	1377.0	735.9	641.1	38.47	22.38	16.09
1200	640	200	8-4-4	1459.6	717.2	742.4	44.54	29.84	14.70
No fertilizer				698.5	698.5				

In the three tables given above the following data is found. Plot 3 fertilized with 600 pounds of 8-4-6 in the Holly Springs Valley land test gave a net gain for 1928 of $41.01 which was the highest gain in the test. 8-4-8 was second, plot (2) $40.18. 8-4-4 was third, $28.23.

In the three years average shown in same table plot 2, 8-4-8 gave an average gain of $28.67 for the three years which is the highest yield in the test. Plot 8-4-6 gave an average net gain of $23.70. Plot 8-4-4 gave a three year average net gain of $21.42.

In the hill land test conducted at Holly Springs Station in 1928, plot 3, Table No. 6, which is 600 pounds of 8-4-6 fertilizer, gave a net gain of $16.88. Plot 2, 8-4-8 gave a gain of $14.79. Plot 4, 8-4-4, $12.21.

In the four year average given in this same table, the highest net gain for four years was with 8-4-6 which was $32.04. The second highest plot was 8-4-4 giving a net

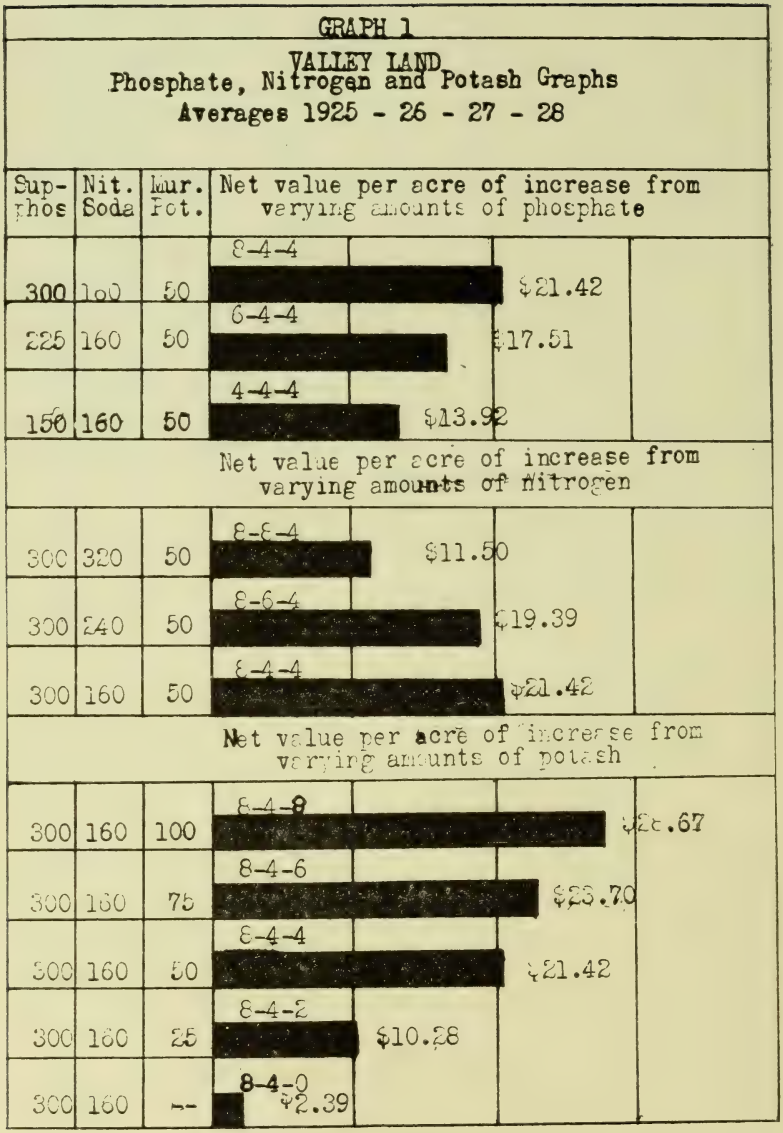
gain of $30.22 and the third highest was 8-4-8, giving an average of $28.46.

In table No. 7, the Panola County co-operative plots, the first years test, the plot giving the highest yield is Plot 2, 8-4-8 giving a net gain of $18.53. Plot 8-4-4 at the rate of 1200 pounds per acre came second with a net gain of $16.27.

There is no marked difference in the fertilizer requirements shown in any of these results. It is evident that phosphorus, nitrogen, and potash in combination give the best results. It seems in a majority of cases 600 pounds of fertilizer was the most economical quantity to use. Taking into consideration our past results at the Station and various co-operative results conducted over this Section of North Mississippi, we find no marked difference in the soil requirements in this part of the State, except on land heavily infested with wilt and rust. The outstanding fact is that a complete fertilizer will increase the yield of cotton very materially, frequently doubling the yield per acre. As can be seen from data given.

GRAPH 1

VALLEY LAND
Phosphate, Nitrogen and Potash Graphs
Averages 1925 - 26 - 27 - 28



GRAPH 2

HILL LAND

Phosphate, Nitrogen and Potash Graphs

Averages 1925 - 26 - 27 - 28

Sup-phos.	Nit. Soda	Mur. Pot.	Net value per acre of increase from varying amounts of phosphate
300	160	50	8-4-4 $ 30.24
225	160	50	6-4-4 $ 17.30
150	160	50	4-4-4 $ 14.64
			Net value per acre of increase from varying amounts of nitrogen
300	300	50	8-8-4 $ 23.62
300	240	50	8-6-4 $ 15.51
300	160	50	8-4-4 $ 30.24
			Net value per acre of increase from varying amounts of potash
300	160	100	8-4-8 $ 28.46
300	160	75	8-4-6 $32.04
300	160	50	8-4-4 $30.24
300	160	25	8-4-2 $20.24
300	160	--	8-4-0 $15.53

8-4-8—811.5 Lbs. Seed Cotton Increase Over No Fertilizer, $40.18.

8-4-6—816.5 Lbs. Seed Cotton Increase Over No Fertilizer, $41.01 Net Gain.

8-4-0—594.9 Lbs. Seed Cotton Increase Over No Fertilizer, $28.23.

No Fertilizer.

Recommendation—The cotton farmers in this section should use 600 to 900 pounds of fertilizer per acre as follows: On improved soils, where legumes have been grown or manures used, should use a mixture of 300 pounds of superphosphate (acid phosphate) 160 pounds of nitrate of soda or its equivalent in other forms of soluable nitrogen, and 50 pounds of muriate of potash or other forms of potash. This mixture is equivalent to 600 pounds of 8-4-4 factory mixed fertilizer.

On the thinner soils where the stalk growth is comparatively small, it will be found profitable to add 80 pounds nitrate of soda, or its equivalent in other forms of soluable nitrogen to the above mixture. This will make an equivalent to 600 pounds of 8-6-4 factory mixed fertilizer. The same quantities of 8-4-4 or 8-6-4 factory mixed can be used provided most of the nitrogen is from a readily soluable source.

From a four year average of both hill and valley land tests, the indications are that an addition to the above mixtures of 25 pounds muriate of potash (or other forms of potash) may be profitable on most land in this section. Where rust is prevalent this additional potash should be added.

The tendency with fertilizer factories now is to manufacture high grade goods. These high grade fertilizers can be sold cheaper per unit than the lower grades on account of saving in freight, sacks, handling, etc. Our recommendations are two parts phosphorus, one part of nitrogen and one part of potash. For example—100 pounds of a 12-6-6 has the same amount and kind of plant food as 150 pounds of 8-4-4. The tendency in some instances is to use more phosphorus than is necessary to balance the nitrogen and potash.

Potash Source Test—The soil used in this test is unimproved sandy loam, the same soil that has been used for the past three years. Each plot was fertilized the same as the past two years. All plots were in triplicate. Lone Star 79 was planted May 14th. Each potash carrier given in the table was applied at such a rate as to supply 24 pounds of available potash per acre. All plots including checks received in addition to the potash, 300 pounds of Superphos-

phate (acid phosphate) and 150 pounds of nitrate of soda per acre in order that deficiencies in these materials would not render the potash comparisons worthless. The increase was obtained by assuming that there was a gradual increase or decrease in fertility from one check to another, as is adopted by the American Society of Agronomy.

Table 8—Potash Source Test, 1928 and Average

	Average for 1926-27-28			Average for 1928	
	Lbs. seed cotton per acre			Lbs. seed cotton per acre	
Pounds of matreial applied per acre	Plot yield	Increase	Per cent increase	Increase	Per cent increase
No potash	1378.9				
50.0 Muriate of potash	1608.9	228.0	16.5	132.0	8.3
41.7 Trona	1518.7	135.7	9.8	169.3	10.9
No potash	1385.0				
50.0 Sul. of potash	1489.0	104.0	7.5	64.4	4.2
200. Kainit	1632.5	246.7	17.8	302.1	19.1
No potash	1386.3				

NITROGEN SOURCE TEST, 1928

This test was conducted on unimproved sandy loam valley land. All plots 1-20 acre in size and on the same soil that was used the past three years. Each plot was fertilized the same as the year before. All plots were in triplicate.

Lone Star 79 was the variety of cotton used. Planting was made May 14th, this being the second planting.

Each nitrogen carrier given in the table below was applied at such a rate as to supply 30 pounds of available nitrogen per acre. All plots including checks, received in addition to the nitrogen, 400 pounds Superphosphate (acid phosphate) and 67 3-4 pounds of muriate of potash per acre in order that deficiencies in these materials would not render the nitrogen comparison useless.

The increase was obtained by assuming that there was a gradual increase or decrease in fertility from one check to another, as is adopted by the American Society of Agronomy.

Table 9—Nitrogen Source Test, 1928 and Average

	Average for 1926-27-28			Average for 1928	
	Lbs. seed cotton per acre			Lbs. seed cotton per acre	
Pounds of matreial applied per acre	Plot yield	Increase	Per cent increase	Increase	Per cent increase
No nitrogen	863.5				
200.0 Nitrate of soda	1318.1	414.8	45.9	481.9	75.6
150.0 Ammonium Sul.	1323.9	380.8	40.4	478.6	66.4
115.5 Leunasalpeter	1191.0	208.1	21.2	423.3	52.6
No nitrogen	1022.8				
138.9 Cal. Cyanamid	1319.8	268.4	25.5	242.2	34.7
200.0 Cal. Nitrate	1504.3	424.3	39.3	453.1	41.5
65.2 Urea	1553.3	444.7	40.1	441.8	37.0
No nitrogen	1137.1				

NITROGEN SOURCE TESTS NO. 2

Two sets of plots were employed in this test. One on hill land of ordinary fertility and the other on unimproved valley land. The results of these two tests were averaged and put in one table. All plots were 1-20 acre each and planted in triplicate.

Table 10—Nitrogen Source Test

Super-phosphate	Nitrate of soda	Muriate of potash	Hill land test	Valley land test	Average
300	160 Nitra-Po.	50	1037.4	1651.6	1344.5
300	171.4 Calurea	0	1073.1	1536.9	1305.0
300	52.2	50	1189.3	1516.9	1352.9

Another season when we get possession of the additional land, most of the sources of nitrogen will be tested in one set of plots.

Side Dressing—Cotton with nitrate of soda. Soil used; unimproved low flat sandy loam valley land. Six plots of 1-20 acre each were used in the test. Cotton was planted May 14th. Excessive wet weather delayed cultivation. Three plots were planted as follows: 300 Superphosphate, 160 pounds nitrate of soda and 50 pounds muriate potash

making an 8-4-4 fertilizer. This application was made under the seed before planting.

Three plots were fertilized as follows: 300 pounds superphosphate 80 pounds nitrate of soda and 50 pounds muriate potash applied under the seed, making an 8-2-4 fertilizer. An additional 2 per cent of nitrogen (80 pounds nitrate of soda) was used as a side dressing when the squares began to form. The results were as follows: 600 pounds of 8-4-4 at planting yielded seed cotton 1727.6 pounds. 600 pounds of 8-2-4 at planting, 2 per cent of nitrogen (80 pounds nitrate of soda) used when first squares were forming, 1499.6 pounds. This gives 228 pounds seed cotton in favor applying all of the nitrogen under the seed before planting. This is only one year's test and should be considered as such. From past results on loam land with clay sub-soil, all of the nitrogen should be applied at planting time. On sandy soils with coarse sandy subsoils, side dressings with nitrogen in a soulable form is more beneficial.

Phosphate Fertilizer Test—Soil, slightly rolling brown loam table land. Date of planting: May 4th. Variety of cotton used, Lone Star 65. All plots were four rows each, 1-20 acre in size, and repeated three times.

Table 11—Phosphate Fertilizer Test, 1928

Pounds of material applied per acre					Pounds of seed cotton per acre		
Super. Phos.	Rhum's Phos.	Nit. soda	Mur. Pot.	Analysis	Plot Yield	Check Yield	Increase
300		160	50	8-4-4	1301.0	1301.0	
	300	160	50		1202.4	1294.0	-91.6
	400	160	50		1157.0	1287.1	-130.1
	600	160	50		1230.4	1280.2	-49.8
Nitrophoska		160 Lbs.		30-15-15	1210.4	1273.3	-62.9
300		160	50	8-4-4	1266.4	1266.4	
Factory mixed		600 Lbs.		8-4-4	1202.4	1251.3	-48.9
375		160	50	10-4-4	1234.4	1236.6	-2.2
450		160	50	12-4-4	1227.7	1221.9	5.8
No fertilizer					991.8	1207.2	-215.4
300		160	50	8-4-4	1193.0		

Note—The 8-4-4 fertilizer was used as the check plot. From the results obtained in table 11 above, it appears that phosphorus at the rate of two pounds to one each of ni-

trogen and potash is very near the correct fertilizer requirement for this section. This being the case, 10-4-4 and 12-4-4 should produce but little more than an 8-4-4 except on fertile land having an extra supply of nitrogen. It appears that there is less available phosphorus in Rhum's phosphate than there is in superphosphate. These results should not be considered conclusive as they are for only one year.

CORN

The seasons this year were unfavorable for corn and all other farm crops. At this Station, corn is mostly grown after winter cover crops are removed from the land such as vetch, oats and vetch, and oats and Austrian Field Peas. This, of a necessity, causes planting in June. As a rule, early plantings of corn give the heaviest yields. When plantings are made earlier than the later part of April in this latitude, the results are often poor stands. Our practice is to turn the land as soon as the cover crops are removed, disk and plant on level. One good rain to settle the soil will almost insure a crop when a good stand is secured. Poor land is a poor place to plant corn.

On account of corn being a crop of low money value, only a small quantity of fertilizer can be used with profit. We have never been able to grow a profitable crop of corn on poor land, regardless of the methods used. If only poor land is available on a farm for planting to feed crops, it would be advisable to plant to soy beans in thirty inch drills. Two or three hundred pounds of 8-4-4 fertilizer would be profitable if used under the seed. The bean crop would be more valuable than if the land was grown in corn.

Soy beans are planted in every row of corn grown on the Station except when experiment tests are being made. Either of the following varieties can be used, according to the purpose for which they are grown: Laredo, O-too-tan, Mammoth Yellow, Biloxi, and George Washington. The Yellow Mammoth and Biloxi are fine for hogs. Soy beans will stand more water than corn. Unsafe wet land can be planted to corn and soy beans and if the corn is drowned out the beans will make a crop. The prime reason for

planting soy beans in corn is to increase soil fertility. With fair stand of beans in corn, when turned under, twelve to fifteen dollars worth of nitrogen is added to the soil per acre besides the vegetable matter which is equally as valuable. It is easy to grow two crops on good land each year. As soon as corn is harvested the beans and corn stalks can be grazed by hogs and dairy cattle. Not later than October 15th this land should be turned and seeded to oats and vetch or rye and vetch. When the grain and vetch or Austrian Field pea are harvested, plant the land again to corn and soy beans. It will be necessary to keep up the supply of phosphorus and potash on land handled in this way. Use these fertilizers under the corn. All of the station corn and bean land was planted this fall to oats and vetch and oats and Austrian Field Peas. The yield of corn on the Station this year was around fifty bushels per acre for an average.

Beans should be planted in every row of corn grown in the State. A dry year, the yield of corn will be reduced probably as much as 25 per cent the first year. The two crops will more than equal corn grown alone. There are many planters on the market that plant both corn and beans in alternate hills any distance apart desired. In the absence of such a planter the corn planter can be used with a bean plate planting the beans on the same row planted to corn. Beans can be planted any time corn is planted. The Station uses a double hopper planter that plants alternate hills of corn and beans about 14 inches apart. Every other hill of corn is removed leaving two hills of beans to one of corn. We believe in the liberal use of all seed to insure a stand. The one seed planters that drop one grain of corn about thitry inches apart cause untold losses by poor stands. It is easy to destroy plants not needed in the growing of any cultivated crop. There are but few crops that replanting skip places will pay. Use about a peck of corn and ten pounds of Otootan beans per acre and you can thin to the desired stand. No full crop can be made without a stand.

Planting—Corn should be planted very shallow early in the season on well prepared seed beds. As stated above there are but few crops that will make greater response to

well prepared soil. Good preparation is half cultivation with corn. We prefer wasting seed corn in order to insure a good stand. This would not be so necessary if the seed were properly selected and tested. On average land, rows forty-two inches apart give very satisfactory results. As the land increases or decreases in fertility, the distance should vary. The more fertile the soil the more closely the corn can be grown; and the thinner the soil, the wider the distance. The distance corn may be spaced in the row is from one stalk 2 1-2 to 4 feet apart in the row. When the corn is planted in 42 inch checks on good land, two stalks per hill is the limit. No land should be planted in corn that does not produce more than 20 bushels per acre. It requires about 20 bushels per acre to pay the cost of cultivation when rent and labor are considered. Plant the thin land to soy beans as a feed crop rather than plant such lands to corn.

Cultivation—When deep cultivation is practiced, it should begin when the plants are small and should be kept up at frequent intervals. For June plantings, medium shallow cultivation is advisable. Four or five cultivations on late plantings are usually sufficient for good results. The cultivator should run about the same depth at each cultivation, regardless of the method used. Plant soy beans in every row of corn to keep up soil fertility.

CORN VARIETY TEST

Plots—One row each, planted in checks and repeated seven times. Date of planting: May 16th. The checks were forty-two inches apart each way and the rows 130 feet long.

Fertilizer—Two hundred pounds superphosphate and 150 pounds of nitrate of soda per acre were used.

Table 12—Corn Variety Test

Variety	Per cent grain	Bushels shelled corn per acre	Rank
Mosby Sta.	85.0	68.3	5
Mosby Delta	85.0	64.9	9
Mosby D. & P. L.	84.9	69.6	2
Mosby Suttle	87.3	61.1	11
Cocke's Pro. Sta.	84.7	70.6	1
Cocke's Pro. Delta	84.6	68.7	3
Hastings	86.7	60.3	12
Delta Prol. 1	84.9	61.3	10
College 47	84.1	67.0	7
Laguna	83.1	58.4	14
Mexican June	81.6	47.7	17
Paymaster, Neals	84.6	65.6	8
Paymaster, Fisher	84.8	67.6	6
Yellow Dent, Ferg.	82.1	54.0	15
Yellow Dent, Sta.	82.2	53.1	16
Golden Dent, R. H.	82.5	59.1	13
Golden Dent, Sta.	80.6	68.1	4

The soil on which this test was conducted was highly improved land. Taking into consideration the corn variety test for the past six years, we make the following recommendations:

Hasting's Prolific, Neal's Paymaster, Mosby Station, Cocke's Prolific and Large Golden Dent Station. Any of these varieties are good. There are objections found by some to Neal's Paymaster. Some seasons the tip ends of the ears are a little inclined to weather damage. Mosby and Hasting's Prolific are two of the best varieties. The large Golden Dent gives the best yield among the yellow varieties. A Prolific Yellow variety is greatly desired in the South.

CORN AND BEAN TEST

This test was planted May 17th on thin valley land. Plots, six rows each, 275 feet long.

Fertilizer used, 400 pounds of an 8-4-4 mixture. All plots were in triplicate. Only four middle rows were used in getting this data. The following is the average of three sets of plots:

Corn alone, average 42.7 bushels.

Corn with soy beans in row, 38.1 bushels.

Two rows corn to one row soy beans, 36.8 bushels.

As can be seen from these results, there is very little difference in corn without beans and corn with beans, only about 5 bushels per acre. There was at least $15.00 worth of nitrogen turned into this soil in this bean crop before planting to oats and vetch. Every row of corn in the state should be planted to soy beans to improve the land. Two rows of corn and one row of soy beans gave splendid results. In making this planting an attempt was made to leave one third more corn on the two rows to make up for the row of beans. This is also a good way to plant corn.

Table 13—Fertilizer Test With Corn

Pounds of material applied per acre	Bushels per acre	Increase
No fertilizer	39.0	
100 lbs. nitrate soda	41.4	3.6
100 lbs. nitrate soda 200 superphosphate	40.5	3.9
No fertilizer	35.4	
100 lbs. nitrate soda at planting. 100 nitrate soda at 1st working	53.	17.4
200 superphosphate 100 nitrate soda 100 nitrate soda, 1st working	41.7	5.5
No fertilizer	36.7	
200 superphosphate 200 nitrate soda	40.7	12.4
No fertilizer	31.8	
400 superphosphate 200 nitrate soda	43.6	10.7
400 superphosphate 150 Am. Sulphate	42.3	8.3
No fertilizer	35.1	
150 Am. Sulphate	47.2	10.8
150 Am. Sulphate 400 superphosphate 200 kainit	46.2	8.5
No fertilizer	38.9	

FERTILIZER TEST WITH CORN

The soil employed in this test was unimproved valley land. Planted to Neal's Paymaster corn May 10th. Plots 1-20 acre each, repeated three times. Weather exteremely wet in spring and very dry at fruiting time.

There is very little to be gotten from the above table. Probably insufficient water supply at fruiting season was one of the controlling factors. It appears that 100 pounds of nitrate of soda at planting and 100 pounds at first working gave the best results. In another set of plots 200 superphosphate and 200 nitrate of soda gave fair results. We have never gotten satisfactory results with fertilizers under corn. Fertilizer is as necessary for corn as for any other crop, but as corn blooms only once the yield is very susceptible to unfavorable weather conditions.

The best yield ever obtained at this station was when 400 pounds superphosphate and 200 pounds nitrate of soda were used before planting. In the above plots it appears that superphosphate is not necessary. This is not borne out in past years results.

Side dressings of nitrate of soda are frequently very beneficial if they are not made too late. However, this is usually the case. The second application should be made when corn is about one foot high, or a little later.

The following method is used for growing corn on this station: Plant the corn on good land; use 300 pounds superphosphate mixed with 200 pounds nitrate of soda or an equal amount of nitrogen in some other soluble form. After securing a good stand cultivate shallow after each rain. All plantings of corn not used for experiment work are also planted in soy beans in the row with the corn. The average yield this year is about 50 bushels per acre, with an oat and vetch crop usually harvested from the land before the corn is planted.

SILAGE

Sorghum produces at least one-third more tonage per acre, and frequently double the tonage on any kind of land, than corn and has very nearly the same feeding value, ton for ton. Japanese and Texas seeded sorghum are

both most excellent varieties. We use the Japanese seeded sorghum altogether for silage. Sorghum will stand a drouth better, and will not damage if harvesting is delayed. This is not the case with corn. Corn blooms but once and if the weather is unfavorable during this period the yield may be poor. The sorghum must be matured to make good silage. Immature sorghum will make sour silage which is very undesirable as a cattle feed.

If sorghum is planted in rows like corn and a small size eight-hole corn plate is used in the planter, the seed will be dropped in bunches about twelve inches apart. Some thinning will be necessary. Cultivate shallow as for other crops. This Japanese sorghum is late maturing. All silage planted on the Station is after a grain and vetch crop is harvested from the land. No time should be lost in getting in the cane. Sorghum did not mature this season until the middle of October. A trench silo on clay soil properly handled keeps silage as good as a concrete silo. They cost only digging. Make investigations.

Fertilizer Used—Where heavy tonage is expected not less than 1,000 pounds of 8-4-4 should be used at planting. A side dressing with nitrogen would pay on most lands.

SWEET POTATOES

The sweet potato crop was almost a failure in this section this year. Many plantings were made after the wet weather ended, and the weather that followed was too dry for proper development. The station planted four acres in potatoes which gave a yield of about 700 bushels. The fertilizer test made was of no practical value and the results will not be published. This test was planted after the wet season and the yield was unsatisfactory. Variety tests in the past have indicated that Nancy Hall is one of the best varieties for this section.

A co-operative fertilizer test was made on the farm of Mr. J. G. Bell in the western part of Marshall County. The yields were so low that the crop was not dug. Regardless of this year's results the Sweet Potato could be made a good money crop and it furnishes a most excellent food for the cattle.

The Sweet Potato is one crop that should be grown by every farmer, and tenant on every farm in the South. It is adapted to almost any type of soil, but probably does best on a fertile sandy loam. An average crop in this section is 200 bushels per acre. It is not infrequent to make double this amount. There is but little difference in the food value between the Sweet and Irish Potato.

The greatest draw-back in Sweet potato growing is diseases. These diseases can be controlled with proper care. Rotation of seed bed and fields used in growing potatoes and using clean seed will eliminate most of the trouble. The State Plant Board is doing a great service in fighting potato and other plant diseases that effect the economical wealth of the state.

Only clean sound potatoes should be used for seed. Vine cuttings planted on land free from disease make desirable potatoes for growing plants. The usual width of rows are three to three and one-half feet. Plants should be set about 14 inches apart in the row for best results.

Fertilizer—Four or five hundred pounds of an 8-4-6 fertilizer will give good results. A freshly prepared soil is very desirable for potato planting. Land prepared and fertilized before a rain is fine for planting following a rain.

The only satisfactory method of growing slips or plants is in hot beds, or when bottom heat is supplied.

Planting—Potato slips or vine cuttings may be planted any time from the first of May in this section until the middle of July. The best results can be had from plantings made the latter part of May and early in June.

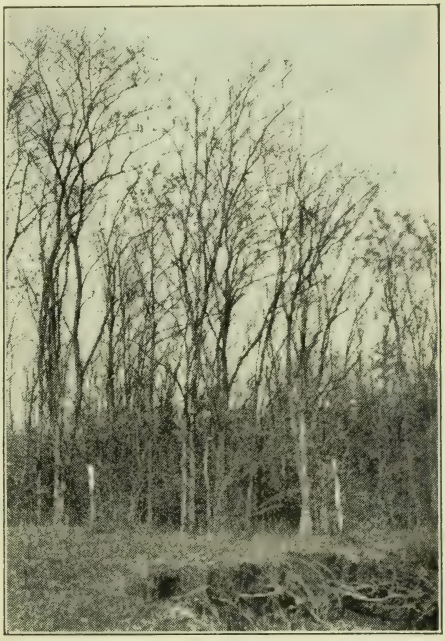
Cultivation—The method of cultivation is simple. Cultivate often enough to keep the weeds and grass out of the crop until the growth of vines cover the soil.

Curing Potatoes—Get rid of the excessive water in the potato soon after digging. If the weather is dry they will dry out rapidly in baskets if kept a day or two in the field or under the shed. If stored in curing houses and the weather is dry, open all ventilators, doors and windows, and allow the air to circulate during the day, closing up the house at night. If the weather is damp, keep fires going in furnace or stove during the day. It usually requires about two weeks to dry out a small house. The old fashion po-

tato bank is O. K. if the potatoes are dried out before covering and they are free from disease. There is no trouble in keeping potatoes through the winter that are properly cured and kept from frost. There is no method that will keep diseased potatoes except to can them.

BLACK LOCUST PLANTING

Seedings of black locust were planted in 1909 on a few acres of gullied land separated from the main farm by a public road. This planting was made to check soil washing and as a hope of future revenue. Below is a cut showing the condition of this planting at this time.



Black Locust Planting.

We estimate this land will yield 500 posts per acre at this time. Some of the trees will make five or six posts each. If we value them at 15 cents each this would give a value of $75.00 per acre which would be an average of $3.60 per acre for the past twenty years. After the trees are cut a second growth can be obtained from the stumps.

VETCH

Circular No. 74 issued by this Station in 1927 is available.

Every land owner should be interested in maintaining soil fertility. After the surface water has been controlled by terraces, the next step would be to grow legumes, either summer or winter to build up the soil fertility. Vetch, Crimson Clover, Bur Clover, Lespedeza, soy beans and cow peas are all good legumes. More profitable crops are grown following legumes without any additional cost. Legumes should be fed to livestock of any kind and the manure returned to the soil. Grow legumes as a cover crop. In most instances the cost is but little more than seeding. The hope of Southern Agriculture is increased production with less cost on less acreage. This can not be done except on good land. Vetch is becoming more popular to be planted every fall on cotton lands and turned in the spring in time for cotton to be grown. This method will reduce the nitrogen cost for the cotton crop far more than the cost of seeding.

Plant 15 to 20 pounds of seed in cotton middle late in September and cover the seed with a cultivator of some kind. Inoculate the seed by mixing one half pound of soil from a vetch field with each pound of seed sown. Rye and vetch or oats and vetch sown in September or early October furnish fine grazing and fine feed. After either of these grain crops are harvested, the land can be planted to corn or beans, or sorghum for silage.

Two Year Rotation—The following practice has been successful at this Station. Plant 15 pounds of vetch seed per acre in cotton middles in September and cover with a cultivator. After rain the seed will germinate. Harvesting the cotton will damage the seeding but little. Allow the vetch to mature, which will be about the first of June. Turn under the first crop and plant to corn or some other crop. The following spring, turn the land and plant to cotton. The volunteer vetch will come up in the cotton middles after a rain in September. Allow this vetch to mature some seed, after which harvest for hay. Turn the land and plant again to some other crop. This method has been in use on some of the Station soil for 18 years. Lime-

ing land, two tons per acre aids the growth of vetch very much. Hairy vetch is the variety used.

LESPEDEZA

A planting of three varieties was made in the spring of 1927, Kobe 04479, Common, and Korean. The average results for the two years are as follows:

Kobe 04479,	3900.4 pounds hay
Common,	2541.4 pounds hay
Korean 49027,	1632.8 pounds hay

Lespedeza adapted itself to the soil on which it is planted from the poorest to the richest but like other plants, it does best on fertile soils. Lespedeza is one of the greatest legumes ever grown in this country. It has been worth millions upon millions to the South for grazing, forage, and restoring soils depleted of vegetable matter. Lespedeza should be planted on all the idle lands of the South. Lespedeza as a hay ranks with alfalfa. The yield is according to the seasons from 1 to 2 tons per acre. The plant appears adapted to this type of soil. Lime is not beneficial. The plant responds quickly to the use of superphosphate and potash. The seed can be sown on freshly harrowed grain in the spring at the rate of one bushel (25 pounds) per acre. It is not necessary to cover the seed with a harrow.

Time and Rate of Seeding—March 1st to the middle of April. There is some danger of frost killing early seedings, when planted on freshly broken and unprotected soils. One bushel of seed per acre is the usual seeding but when 1½ bushels are used much better results can be had.

SOY BEANS

The soy bean should occupy first place as a forage crop for the hill section of the state. Laredo, O-too-tan, Biloxi, and Yellow Mammoth are standard varieties and are especially adopted to Southern agriculture. There are several new varieties of promise now being developed by the plant breeder at the Delta and Main Station.

The O-too-tan and Biloxi are both late maturing verieties and should be planted early for the best results. Either of the above varieties make a most excellent quality of forage and grain combined. When grain for hogs is de-

sired the Mammoth Yellow and Biloxi should be used.

There are many varieties of soy beans on the market and all have their place for various conditions over the United States.

On account of weather and other conditions it was almost impossible to make an early planting of beans.

Planting Time—Any time from the middle of April until about the middle of July is a good time for planting this crop. On this type of soil it is not advisable to grow soy beans broadcast unless the soil is unusually fertile. The majority of soils are too thin for sowing broadcast. If the rotary hoe is used in cultivation much better results could be had. It requires about 10 pounds of Laredo, O-too-tan, or Virginia beans to seed an acre in 30 inch rows. One half bushel each of Yellow Mammoth or Biloxi is required to seed an acre of these varieties, as the seed are much larger. Soy beans will grow on land too wet to grow good corn. Much of the wet land should be planted to corn and soy beans and if the corn is drowned out the beans will make a crop.

Most of the hay on the Station farm is soy beans planted after early spring crops.

Soy beans are planted in every row of corn not used for experiment purposes on the farm, and after oats and vetch are harvested. The land is broken broadcast and disked and the bean seed drilled in rows about thirty inches apart.

Two cultivations are usually sufficient to insure a good yield. If a rotary hoe is used other forms of cultivation could be dispensed with. The rotary hoe covers an eight foot space and pecks up the entire surface. A good team can cover from 15 to 18 acres per day. Three or four hundred pounds of an 8-4-4 fertilizer gives good results. Two tons of lime per acre adds greatly to the yield of the soy bean.

Inoculation—Inoculation is of greatest importance. Many plantings prove a failure for lack of proper inoculation. Land on which a small quantity of stable manure has been broadcasted gives good results when the seed are inoculated. Use about ½ pound of soil from a well inoculated field, to each pound of seed.

Variety Test—Soils, valley land above the average in fertility. Date of planting, May 17. The wet seasons made cultivation very deficient. The results given below are only fair:

Table No. 14—Soy Bean Variety Test

Variety	Pounds of hay per acre	Bushels beans per acre
Delta 488	7319.2	7.8
Delta 491	4564.6	6.0
Tanlaxi	3629.3	10.1
Loxita	3675.9	8.1
Midwest	5844.6	11.7
George Washington	5578.9	9.6
Ebony	3697.3	7.5
Laredo	6128.0	9.0
Mammoth Yellow	4369.2	8.9
Tokio	5941.9	4.5
O-too-tan	7449.5	7.6
Biloxi	2638.3	8.1

ALFALFA

The cut given below shows the result of plantings made in the fall of 1927. Extreme heavy rains and freezes dam-

Alfalfa—1½ Tons First Cutting After Seeding.

aged the stand to some extent when the plants were very small. The soil on which this planting was made was red

clay hill and brown loam valley land. 500 pounds of superphosphate and 100 pounds muriate potash per acre were used. A fair application of stable manure was applied in the spring of 1927. A spring seeding was made with poor results, the land was turned and seeded in the fall. September has proven to be by far the best time to plant alfalfa in this section.

First cutting 1½ tons per acre. On account of the extreme dry summer and fall only three cuttings were made this year. The requirements for growing alfalfa in the brown loam are: a fertile soil, well drained, the addition of four or five tons of lime per acre, 1,000 pounds of phosphate rock or 500 pounds of superphosphate and 100 pounds muriate of potash per acre. A well prepared firm seed bed, and fall seeding. It requires about 25 pounds of seed per acre. When alfalfa has its requirements there is no better forage crop.

DAIRYING

The Station now owns a herd of Registered Jersey cows. From the time the Station was established it was recognized that dairying and poultry, and in some instances hogs, would be necessary to furnish a market on the farm for legumes and other crops grown, and to utilize the idle lands for grazing.

North Mississippi will never come into her own until dairying, poultry, pigs, cotton, and feed growing becomes her chief industry. In the past, the dairy has been run so as not to interfere with regular Station work, leaving the experiment a feature to the College herd at the A. and M. College of Mississippi. Most of the milk secured is sold locally at the dairy barn and the balance is separated and the cream shipped on the butter fat basis. The skimmed milk is fed to calves and poultry. This method interferes but little with regular station work.

Several projects are in progress to ascertain the value of manure measured in pounds of cotton, or other crops; also a system of rotation including forage crops suitable for dairy feeds, etc. These results will be reported later.

The dairy possibilities in this section are good. Cream

and milk markets are close in almost any direction, with good roads in practically every county. There are thousands of acres of idle lands that could be used in growing feed and making pastures. Good cows are available and cream separators can be had at almost one's own terms.

How to Begin Dairying—The following is a suggested way to begin dairying: Get together a few cows, the best available, purchase a separator, if necessary, and start milking. Breed these cows to a first class bull of a dairy type, and in a few years you will have a herd of cattle. Sell off the poorest producers as fast as possible and replace with good cows. Keep daily records of every cow to determine her value. Four or five real good cows will pay a greater profit than ten to fifteen ordinary milk cows. It is hard to pay too much for a good milk cow. There is idle labor on the farm half the year that has to be fed. The South has advantage in her favor in mild winters, cheap lands, cheap labor and long growing seasons. Inexpensive barns can be used. We will succeed when we become "Dairy Minded" and not until then. Dairying should interfere with the growing of cotton but little, in fact in a few years more cotton should be grown.

Pasture—Good pastures are almost as essential to succesful dairying as good cows. The land should be prepared by cutting the bushes and unnecessary trees, terracing to control soil washing, and breaking with a plow and seeded with bermuda grass, lespedeza, white and hop clover, Dallas and Carpet grass. It may not always be the best plan to break up a pasture to add other seed. Lespedeza, carpet grass, Dallas grass, hop clover and white clover can be added in the spring without plowing. We find a good practice to divide the pasture and plant one part one year while the cattle are grazing the unbroken part and the next year reverse the order.

The use of a mowing machine once or twice a season, usually July and September is the best way to handle a pasture. The cattle eat the grass and the weeds fight the grass, so both cattle and weeds frequently win the fight.

Forage Crops—Dairying and purchasing feed is like growing cotton and buying feed for labor and work stock, —it cannot be done successfully under average conditions.

The best forage crops for this section are soy beans, sorghum, sudan grass, lespedeza, and cow peas. One acre per cow when good land is used should grow sufficient forage. All of the forage and feed should be grown on the farm with probably the exception of some grain. There is no better dairy feed than silage, legume hay, ground corn and cob meal, cotton seed meal, and wheat bran or ground oats. All of these with probably the exception of the bran, are easily produced on the farms in this section.

Thirty-five pounds of silage, ten pounds of legume hay, and one pound of the following mixture to each three pounds of milk is a good ration. Two pounds of corn and cob meal, one pound cotton seed meal, one pound ground oats mixed.

Probably more cow trouble comes from feeding an excessive amount of cotton seed meal to dairy cattle than from any other source. There is no cheaper or better protein feed on the market than cotton seed meal as far as it can be used.

Dairying does not mean less cotton, but more fertile soil on which to grow larger crops. In addition to this it frequently means double the revenue from the farm.

In conclusion, I wish to state that Mr. Otis B. Casanova and Mr. O. K. Morgan have assisted very materially in the success of the year's work, also Mr. Leo Bates, who has charge of the dairy.

Dr. B. M. Walker and Director J. R. Ricks have been very kind and pleasant in directing the work.

Bulletin No. 265 December, 1928

GROWING SATSUMA ORANGES IN SOUTH MISSISSIPPI

Satsuma tree four years old, Pearl River Highlands Company, Carriere, Mississippi

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. COLLEGE, MISSISSIPPI
J. R. RICKS, Director

Growing Satsuma Oranges in South Mississippi

By

W. S. ANDERSON, *Horticulturist, South Mississippi Experiment Station*

In the following pages we shall endeavor to discuss very briefly some of the things which should receive primary consideration in establishing and managing a commercial satsuma orange grove in South Mississippi. Attention will be given to location and site for the grove; land preparation; selection of varieties, and trees; setting trees; pruning; cultivation; fertilization; intercropping; pest control; winter protection; and harvesting.

SELECTION OF A LOCALITY FOR A GROVE

In determining whether a locality is suited to commercial satsuma orange culture, it is important to study first the climate of the section, and then ascertain if the soil is the right kind. Climatic considerations still easily lead as the limiting factor in any citrus fruit culture. Since the inception of the use of *Poncirus trifoliata* as a stock for satsuma oranges, the potential citrus producing belt of this country has widened fifty to seventy-five miles further north, yet the prospective grower should have accurate information of the territory before deciding to set satsuma orange trees extensively. In cooperation with the Weather Bureau of the U. S. Department of Agriculture, our station has kept since 1903 a daily record of maximum and minimum temperatures and rainfall. This record was kept at McNeil until the removal of the station to Poplarville in 1919. Studying this weather record rather carefully one will note that December, January, and February represents the coldest months of the year in this section. Looking further at these records, we find that the lowest minimum temperature recorded in December during this period of 25 years was 14° F. and that only once. In January the lowest recorded was 12° and that only once; while we notice in February the lowest recorded was 13° and that occurred only once during the period. The average of all the lowest temperatures in the month of January was 22°, that for February was 25° and for December, 25°. As to the rainfall of this section the record shows that there is ample rainfall in every year to take care of the needs

of satsuma orange trees under any ordinary conditions. Our observations have been that where planted on the proper site and when given good care this tree will withstand temperatures as low as 15° without wood injury. In the plantings at this station 16° above zero has defoliated trees but has never injured the branches.

Besides climatic considerations there is to be considered by the prospective satsuma orange grower the ease with which the crop can be gotten to market. Such matters as distance from central packing houses or from railroad and the ability of the railroad serving the territory to haul perishables satisfactorily to northern and eastern market centers, should receive attention. Also, the new settler should find out how satisfactory are the schools, churches, roads, and other organizations which help to make the farm home life more desirable.

Satsuma orange groves are planted at present on "pine lands," "flat woods lands" and "high or low hammock lands." According to the Soil Surveys of the U. S. Department of Agriculture, the soils best adapted are Greenville and Norfolk Sandy Loams. We would say that the soil best suited to the growth of this fruit is a fine sandy loam with a clay subsoil, well drained, and of good natural fertility. One should avoid planting on low, damp soils and those having very sandy subsoils.

A site selected for the satsuma orange should be one which has as perfect air drainage as possible. The grower should also see that the composition of the soil is not too light and that the slope towards the south is moderate. This slope is not to be over one inch per foot if there is high land across the valley, because the wind will disperse the cold air from the surface of the ground on the northern part of the slope, but will not do so on the southern part. The importance of this is increased if a stream is on the south edge of the slope. It should be kept in mind that it is the cold, damp, air that settles over the surface of the ground which damages trees rather than cold wind blowing through the orchard.

PREPARATION OF LAND FOR PLANTING

After one has decided to plant an orchard of satsuma oranges in a locality and has selected a desirable site for the orchard, it then becomes important to prepare the land for planting. All stumps should of course be removed first. Bulletin 159 of the Mississippi Experiment Station describes several good

methods of clearing pine lands of South Mississippi. Burning is practiced more in the clearing of pine stumps than any other method. If possible to do so, the grower should plow the land broadcast, disk and harrow it and grow a crop on it one year before setting out the trees. A crop of soy beans or cowpeas can easily be grown the first year to put the land in good cultivation.

The amount of rainfall in South Mississippi and the texture of some of the soils make it important to give attention to the amount of slope. It is the opinion of the leading agricultural engineers that when land in South Mississippi has a vertical fall of 1½ to 3 feet each 100 feet horizontal distance, depending upon type of soil, it should by all means be terraced. When land is terraced, it has seemed to be more desirable to plant the trees on the contours of the slope and cultivate with the contours. Copeland (9) says this about planting orchards where land is terraced: "In orchard planting it is generally recommended that trees should be set just under the terrace ridge but on the terrace. Secondary rows are then set between the terrace and parallel to the terrace above—in cultivation these lines become secondary terraces which further protect against soil erosion." Before laying out a hilly orchard every grower should request from Mississippi Extension Division, A. & M. College, Mississippi, a complete list of blueprints on terraces. These show in detail how the work is done. Of course, if the grove is to be planted on plateau land, or land that is not liable to erode from cultivation in both directions, the trees should be planted in straight lines. This adds to the beauty of the grove as well as makes it easier to handle cultivating implements, spraying machinery, and harvesting wagons.

SELECTION OF VARIETIES AND TREES

Owari is the only variety of satsuma orange recommended for planting for commercial purposes. This variety is earlier and has better quality than *Ikeda* which is sometimes planted. The prospective grower should be sure that trees bought are worked on stocks of the trifoliate orange, *Poncirus trifoliata,* as this is the only stock recommended for use under South Mississippi conditions. Nurserymen in the section are aware of this, however, and little trouble should be experienced in the matter of getting the right stock. Results seem to show that year-old buds, that were worked on one and two-year-old stocks, make the best and cheapest trees to set out.

Satsuma tree in Experiment Station orchard showing growth made during 1924 following freeze.

SETTING TREES

When planting in straight lines any one of the systems illustrated on the following pages may be employed that suits the growers. Figure 1 illustrates the triangle system. The rectangular or square system is shown in Figure 2. This is by far the simplest of all planting systems and is used more than the others. Figure 3 illustrates the hexagonal system. This system is the only one in which each tree is equidistant from each of its neighbors, and the only one that equally divides the space. About 15% more trees can be set to the acre than by the square system. Figure 4 illustrates the quincunx system of planting. By this system about 78 per cent more trees can be set per acre than by the square system. Table No. 1 shows the approximate number of trees to plant an acre by the different planting systems and for different distances.

For the best lands of the Coastal section, it is usually considered best to plant satsuma orange trees at least 20 feet apart in each direction. Some even advise 20 by 25 feet. If planting is done along the northern border of the satsuma belt where there is more likelihood of injury from cold, it is usually conceded best to plant more trees per acre and some even plant as close as 15 by 15 feet.

TABLE No. 1

APPROXIMATE NUMBER OF TREES TO THE ACRE FOR DIFFERENT PLANTING SYSTEMS

Distance apart	Triangular	Rectangular (square)	Hexagnol	Quincunx
15 by 15 feet	175	193	217	247
20 by 15 feet	132	145	---	---
18 by 18 feet	122	134	142	247
20 by 20 feet	98	108	124	199
25 by 20 feet	79	87	---	---
25 by 25 feet	64	70	81	126

Before setting out trees, the orchard should be laid out carefully and as accurately as possible, using any convenient means to establish each tree position. A stake should be driven where each tree is to be set. In digging the holes and in placing the trees it will be found very advantageous to use a "planting board." This simple contrivance is illustrated in the drawing below:

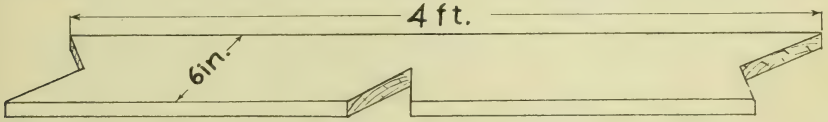


Fig. 5. "Planting board", consisting of a board 1x6 inches and 4 feet long, with a notch cut in one edge near the middle and in each end.

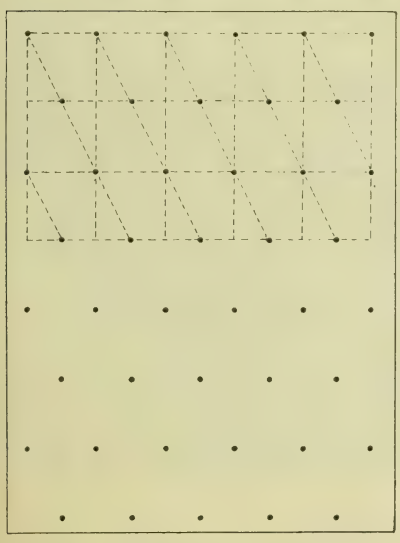


Fig. 1, triangular system

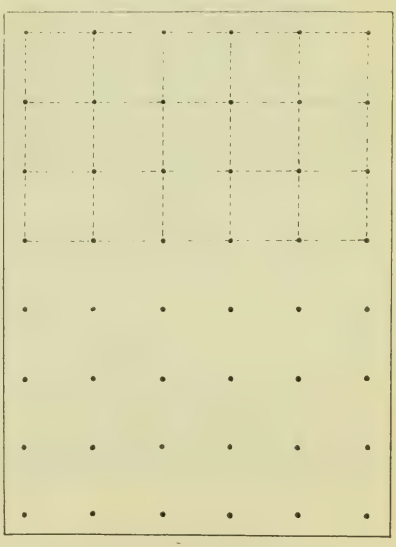


Fig. 2, rectangular system

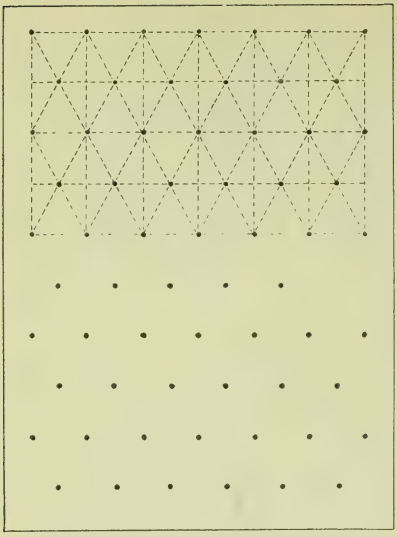


Fig. 3, hexagonal system

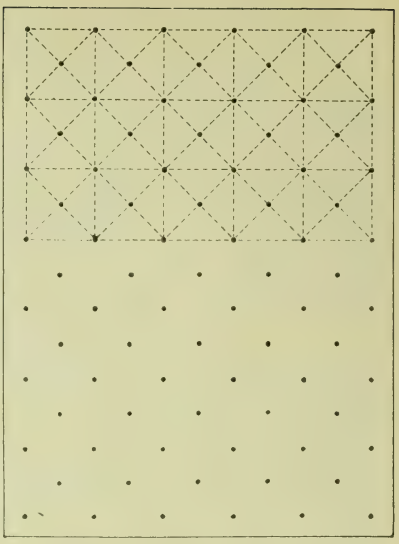


Fig. 4, quincunx system

Satsuma Grove being cultivated with good equipment including Fordson tractor and disc harrow.

Satsuma orchard five years old in 1927. Pearl River Highlands Company, Carriere, Mississippi.

To use the planting board, it is necessary only to place it flat on the ground across the tree row so that the center notch fits over the tree stake, place a small stake in each end notch, remove board and dig hole about tree stake. When placing tree for setting, put board back into the same position and set tree trunk in center notch. The tree will then be properly lined with the others. If planting is done in extreme dry weather, a pail of water should be poured into each hole before the dirt is filled in around the roots. It is usually recommended that tree be set in the latter part of the dormant period, which is in February, while they may be set any time during the winter months.

PRUNING

Very little pruning is considered necessary for Satsuma orange trees and indeed little is actually done in groves now established. It is more desirable to have the trees form low heads. Dead growth and undesirable branches should be kept cut out as the tree develops, and long, weak limbs should be headed back so as to keep the trees compact and symmetrical. Of course, each tree should have a framework of three or four main branches. In case of freeze injury cut back all dead branches, as soon as the extent of the damage can be determined.

CULTIVATION, FERTILIZERS, COVER CROPS AND INTERCROPPING

In South Mississippi the satsuma orange grove should be kept in good tilth throughout the growing season. Nearly all of our soils can be greatly improved by the growth of leguminous cover crops in the orchards, and it is therefore advised that frequent shallow tillage be practiced from March until a summer cover crop of cowpeas or soybeans is planted in June. Such handling of the groves will so harden the trees that they will be much more able to stand freezes. This crop may be cut into the land with a disk in the fall and a crop of Austrian Winter peas can be sown for growth during the winter. Several species of *Crotalaria* are being tested as summer cover crops also, and some of them may prove quite satisfactory. *C. spectabilis* and *C. striata* are two of the most promising kinds at present. The former was formerly called *C. sericea.* When land for cultivated field crops is scarce it is permissible to practice intercropping but advisable to grow only such low-growing crops as the several adapted truck crops. The only advantage of intercropping is the possibility of income from the land before the trees reach bearing age. The trees should never be allowed to suffer from crops grown between them.

For economical production South Mississippi seems dependent upon applications of commercial fertilizers to all crops. Satsuma oranges are not an exception in this respect. This station has been doing no fertilizer testing with this fruit, but has been getting very satisfactory results from an 8-4-4 analysis applied in March and two pounds of sulphate of potash applied per tree August 1. On pre-bearing-age trees we would recommend the use of 3 to 6 pounds of the above analysis for the spring application, followed by an early fall application of potash. Amounts per tree should depend upon the natural fertility of the soil and whether legumes are grown as cover crops, and it should be increased by at least one pound per year. For bearing trees we would advise 5 to 12 pounds per tree, depending upon the size and age of trees as well as natural fertility and amount of leguminous cover crops grown, to be applied about the time growth starts in the spring, followed by the early fall application of some form of potash, in amounts ranging upward from 2 pounds per tree of sulphate, depending upon size of crop on the trees.

PEST CONTROL

Chief among the pests that the grower of satsuma oranges will find it necessary to combat are scab, scale insects, white-fly, rust mites, and red spiders. Much of the information now in print about the control measures for these pests is being debated. However, we have summarized the suggestions made by the leading entomologists and pathologists of the section and after checking this against the results obtained by the most successful growers of the satsuma orange belt, have made up a spray calendar for use as a guide in controlling these pests. This calendar is shown in Table 2.

TABLE No. 2—SPRAY CALENDAR.

	First spraying	Second spraying	Third spraying
Time	Just before growth starts in spring	When ¾ blossom petals have fallen	June or July, when insects appear
Material	Bordeaux mixture 3-3-50 plus ¾ to one gal. oil emulsion	Bordeaux mixture 3-3-50 plus 3 pints oil emulsion (Spreader)	Sulphur dust or conc. lime-sulphur 1-70
Pests	Scab, scale insects, white flies.	Scab	Rust mite and red spider.

NOTE: The third spraying may need to be repeated. The number of applications can be determined by the grower's observation. If the red spider is very bad it will be necessary to make an application of concentrated lime-sulphur during the winter, at a strength of 1 to 50. If the temperature is above 85° F. dusting could be done satisfactorily. If scale and white-flies are bad, an early dormant spray of oil emulsion, at a strength of one gallon to fifty gallons of water, might well be applied, but be sure this is done four to six weeks before any cold weather comes. Trees thus treated do not suffer from cold as do those sprayed with oil immediately before occurrence of low temperature.

The grower of satsuma oranges will very often find it necessary to provide some means of protecting trees while young against injury by rabbits. In a great many cases these animals have so girdled the trees by gnawing the bark that many trees were killed entirely. The simplest method used for protecting trees has been to wrap loosely around the base of the trunk to a height of 12 to 18 inches old newspapers or maga-

zines. A more permanent contrivance can be prepared by cutting strips of screen wire wide enough to make a miniature cage around the tree trunk to the desired height. Such cages can be placed on the tree or removed when necessary and stored away for future use. Whenever such protective measures are used they should be taken away when banking and should never be wrapped tightly around the tree.

WINTER PROTECTION

Of primary importance in protecting satsuma orange orchards from winter injury is having the orchard on the proper site. Elevation being sufficient, and there being freedom from obstructions on all sides, affording perfect air drainage, there is left only soil drainage to be looked after. Be sure the soil has drainage even if tilling is necessary. The only artificial means of protection recommended at this time is the practice of banking the trees to a height of 12 to 18 inches with dirt. The more sandy or loamy top soil is more desirable for banking than is clay. These embankments should be made in early winter before there is any cold weather, and should not be pulled down until after all danger of freezes has passed. Following the severe freeze of 1917 when many trees suffered injury in South Alabama and South Mississippi an investigation (7) in the former state revealed that 54.5% of the growers did not practice banking before the freeze mentioned. The remaining 45.5% banked to a greater or less extent, and these growers reported that 68.5% of their trees were saved which would have otherwise been damaged. On January 6, 1924, a sudden drop in temperature to 12° F. killed the then four-year-old trees at this Station to the banks. These trees were cut back and at the end of the growing season of that year these trees had made several feet total growth as is seen in the photograph in Plate 4. A report from this station for 1925 shows that one tree in this orchard made 107 fruits that year, and the 1926 report shows that a maximum number of 10 dozen fruits were made on these trees. Protection of the base of the tree by banks enables the strong root system to force out a new framework for a tree early after cold injury.

HARVESTING AND MARKETING

In harvesting satsumas the fruit should be clipped rather than pulled from the stem. Various patented types of harvest-

ing shears are on the market, and can be obtained cheaply. Picking bags are preferred instead of baskets as they are more convenient. Good field boxes should be provided to handle the fruit from the orchard to the packing house without excess bruising. Grade the fruit carefully, giving the buyer the benefit of any doubt about a cull. Class the oranges as brights or russetts, and then divide each class into at least two grades. It should be wrapped in printed paper, and packed so that a solid, uniform, and full package can be offered the market. The fruit is put up in half-boxes or straps, and these should be labeled as to name, quality, and size. Different sizes of satsuma oranges make necessary different styles of packing. Below are illustrated the various packs used.

Whenever possible the grower should become affiliated with cooperative marketing organizations, as this will prove invaluable in the orderly marketing of this crop of fruit.

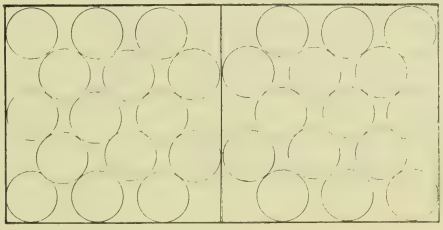


Fig. 6. 90s, 3 inches, 3 layers, 15 fruits each layer.

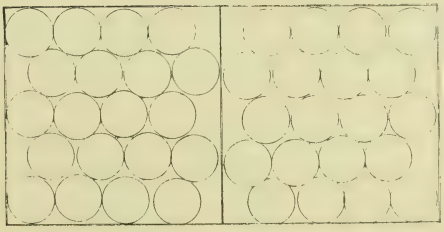


Fig. 7. 120s, 2¾ inches, 3 layers, 20 fruits each layer.

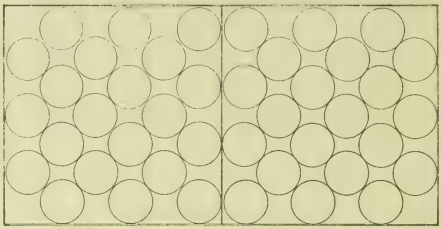


Fig. 8. 168s, $2\frac{1}{2}$ inches, 4 layers, 21 fruits each layer

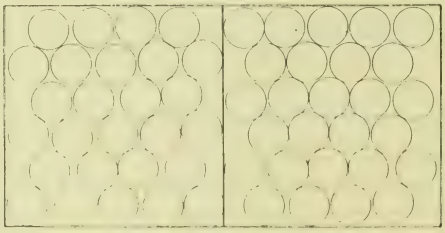


Fig. 9. 216s, $2\frac{1}{4}$ inches, 4 layers, 27 fruits each layer.

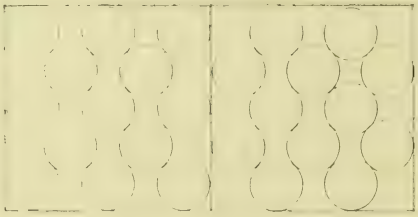


Fig. 10. 76s, $3\frac{1}{4}$ inches, 3 layers, 13 fruits layers one and three and 12 fruits layer two.

ACKNOWLEDGMENTS

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Bulletin No. 266 December, 1928

REPORT

OF THE

SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION FOR 1928

By

W. R. PERKINS, W. S. ANDERSON
and
W. W. WELBORNE

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. AND M. COLLEGE, MISSISSIPPI,
J. R. RICKS, DIRECTOR

REPORT *of* THE WORK *at* THE SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION

By W. R. Perkins, W. S. Anderson and W. W. Welborne

The work of this station for 1928 was planned and carried out to the time of harvest by Mr. E. B. Ferris, who resigned the first of September. He was assisted by Mr. W. S. Anderson in Horticultural work and by Mr. W. W. Welborne in the field crop work.

The scope of the work was rather extensive, requiring more than 900 plats which were fertilized, worked and harvested separately, and covered pretty fully questions of fertilizers, soil improvement, varieties of plants and the testing of new crops.

The year 1928 was on the whole very unfavorable for crop production. The total rainfall for the year was 83 inches, while average for the past ten years was 56.95. 19.43 inches of rain fell in June. During July the rainfall was 10.46, not an excessive amount, but there were 16 days during the month on which rain fell; August with 7.28 inches and 20 days on which there was rain, made conditions exceedingly unfavorable for the cotton crop. The rainy weather in April coupled with the abnormally low temperatures made the securing of stands very difficult, and practically all of the cotton crop had to be planted the third time before stands were secured. The land on the station farm is all more or less rolling and quite irregular in fertility for plat work. The heavy rains of the year made these irregularities worse by the washing of the land.

ROTATION EXPERIMENT

Since 1919 there have been 84 plats, 1/20 acres each, used in testing different cropping systems on 21 plats, replicated four times. We are using 12 cropping systems in which cotton is used in seven rotations. On one plat of each series, cotton has been planted continuously, and the results show that less than 100 pounds of seed cotton per acre has been the average yield on the four series. For the past three years, the plots that

have been planted to cotton continuously have gone largely to pieces as a result of wilt. Due to adverse weather conditions, and high percentage boll weevil infestation, the yield obtained does not show any great difference and we do not give the summary table showing the results of this work.

FERTILIZER TEST ON ALFALFA

Twenty-five one-twentieth acre plats were devoted to alfalfa tests in 1927. These plats were limed February 22, at the rate of three tons per acre. On October 8, 1927, the plats were disked well, and alfalfa seed sown. This was followed by a very hard rain, seed came up fairly well but the young plants died badly, leaving a poor stand. On February 10, all plats were given a uniform application of an 8-4-4 fertilizer at the rate of 400 pounds per acre. The plats receiving fertilizer in 1927 were given same amount on February 13, 1928. On February 20, the entire field was planted again to alfalfa seed sent here from the Main Station. This field of alfalfa was cut three times and the records kept. The table following gives the results and explains it in detail.

TABLE NO. 1

Fertilizer Test on Alfalfa—1928

Treatment per A.		Plot Yield			Av. Yield per acre	Check Yield	Increase
Pounds	Analysis	1st cut May 10	2nd cut June 26	3rd cut. Aug. 1			
Check		427	295	175	5980		
1200	8-0-0	470	300	205	6500	5802	698
1200	8-4-0	640	435	275	9000	5623	3377
1200	8-4-4	605	430	375	9400	5445	3955
Check		330	295	165	5266		
1200	0-0-4	350	290	235	5832	5052	780
1200	0-4-4	455	370	225	7000	4839	2161
1200	8-0-4	440	320	230	6600	4625	1975
Check		292	225	145	4412		

NOTE: A basic mixture of an 8-4-4 home mixed fertilizer at the rate of 400 pounds per acre was applied uniformly over all the plats, February 10, 1928. This made a total application of 1600 pounds to all plats except the checks.

CORN, SOYBEANS, AND SIX WEEKS PEAS

Approximately 40 acres of our land not suitable for experimental work, was planted to corn, soybeans, and six weeks peas this year. Nearly 20 acres of land in one field had been in

pasture for the past two years, the other field having been in cultivation about three years.

The rows were all approximately three feet wide, two having been planted to corn and the third row to peas. The field that had been in pasture for the past two years was planted to corn about the 20th of February and was fertilized very lightly with Nitrophoska on April 15. The pea rows were fertilized with a small application of a general mixture of fertilizer remnants of varying analyses and planted to six weeks peas about April 26. Early in May, Laredo soybeans were planted between hills of corn and covered as corn was cultivated. The beans never did get up to any size, due to a two-weeks drouth. The peas made excellent growth, and fruited heavily. About half of these peas were picked at maturity, and used for planting purposes. The others were left for a bunch of hogs to eat. These hogs were put in the field about the first of July. The corn and peas were plentiful until the first of September.

In the second field, where corn, soybeans, and cowpeas were grown in 1927, the land was prepared and fertilized in February with an 8-4-4 fertilizer at the rate of 300 pounds per acre. Corn was planted in water furrows about March 10 and six weeks peas planted in every third row about April 10. Soybeans were planted between hills of corn about May 10, but did not make very good. The peas and corn made excellent yield.

FACTORY VS. HOME MIXED FERTILIZERS UNDER CORN

Twenty-five one-twentieth acre plats were used in this test where cotton had been grown for the past two years under this same fertilizer test. We are comparing three factory mixed fertilizers with home mixed fertilizer furnishing the same amount of plant food. In mixing the home mixed fertilizer, superphosphate (acid phosphate) nitrate of soda, and muriate of potash, were used in the proper proportions to furnish the same plant food as would be supplied by the factory mixed fertilizers. The fertilizer was applied on March 28, at the rate of 600 pounds per acre, and planted to Cocke's Prolific corn, April 2. Table No. 2 gives the average results of this work, the averages being of triplicate tests in each instance.

TABLE NO. 2

Factory vs. Home Mixed Fertilizers Under Corn—1928

Lbs. Material Applied per Acre		Analysis	Yield Bushels Ear Corn per acre		
Factory Mixed	Home Mixed		Plot Yield	Check Yield	Increase
No fertilizer			14.92		
600		8-4-4	23.43	15.39	8.04
	600	8-4-4	21	15.86	5.14
600		8-5-4	20.62	16.33	4.29
No fertilizer			16.80		
	600	8-5-4	24	16.91	7.09
600		10-5-3	26.14	17.02	9.12
	600	10-5-3	21.35	17.13	4.22
No fertilizer			17.25		

NITROGEN SOURCES TEST

Twenty-five one-twentieth acre plats which had been used for three successive years in similar tests under cotton, were used this year for corn. Six sources of nitrogen were used in this test with all the plats receiving the equivalent of 600 pounds per acre of an 8-0-4 fertilizer and the nitrogen plats receiving 48 pounds of actual nitrogen per acre. This fertilizer was applied March 23, and Cocke's Prolific seed corn planted March 31. Table No. 3 gives the result of this work in detail.

TABLE NO. 3

Nitrogen Sources Test—Corn—1928

Lbs. Material Applied per Acre	Analysis	Yield per Acre	Check Yield	Increase	Value Increase $1 Bu.
600	8-0-4	15.73			
320 Nitrate soda	8-8-4	32.84	16.47	16.37	16.37
240 Ammonium sul.	8-8-4	34.96	17.21	17.75	17.75
220 Cal. cyanamide	8-8-4	38.88	17.94	20.94	20.94
600	8-0-4	18.68			
300 Cal. nitrate	8-8-4	38.75	18.01	20.74	20.74
105 Urea	8-8-4	36.52	17.34	19.18	19.18
185.6 Leunasalpeter	8-8-4	31.77	16.67	15.10	15.10
600	8-0-4	16.00			

VARIETIES OF CORN

There were 18 varieties of corn under test this year, all with the exception of two varieties were sent from the Main Station, these two varieties being Anderson Choice and Howard, which was obtained locally. These varieties were planted in a single row, sixteen of these being repeated ten times each and two varieties only eight times each. These varieties were planted on land where cotton varieties had grown in 1927. Fertilizer applied March 29, at the rate of 100 pounds per acre of an 30-15-15, factory mixed fertilizer, which is almost the equivalent of 400 lbs. of an 8-4-4 fertilizer. These varieties were planted on May 8, this being the second planting due to the bud worms being so bad.

In harvesting these varieties the corn was husked and weighed, and about equal quantities of each were put aside for later determination of percentage of grain and separation into first, second, and third grades, as a measure of the soundness of this corn. In getting the yield per acre in bushels, seventy pounds was taken for a bushel. Table No. 4 gives the figures obtained with these varieties and it will be seen that the percentage of grain in the ears varied from 80% with Ferguson Yellow Dent to 91% with Mosby Suttle.

TABLE NO. 4

Corn Variety Test—1928

Variety	Bu. per A.	% Grain to Cob	% First Grade	% Second Grade	% Third Grade
Mosby Station	36.64	85	89	7	7
Mosby Delta	23.65	85	89	4	1
Mosby D&PL	34.37	83	83	12	2
Mosby Suttle	27.72	91	81	15	0
Cocke's Prolific Sta.	39.90	85	90	7	0
Cocke's Prolific Delta	39.94	86	79	17	6
Hastings	34.71	85	91	6	0
Delta Prolific Delta	29.18	86	75	20	1
College 47	41.01	85	78	16	0
Laguma	38.24	84	79	13	3
Mexican June	37.84	84	80	15	0
Paymaster Neal	31.71	83	50	42	0
Yellow Dent Feguson	28.63	80	5	73	14
Yellow Dent Station	30.51	81	56	38	2
Golden Dent R. H.	31.41	86	14	75	3
Golden Dent Station	31.88	81	63	30	4
Anderson Choice	27.70	85	89	7	1
Howard	28.71	87	70	24	0

ANALYSIS TEST—CORN

This regular fertilizer work under corn was conducted on the same land for three successive years, but a change was made this year, planting the corn where sweet potatoes had been under the same fertilizer test for three successive years. This did not change any of the plats to different fertilizer heretofore used. Fertilizer was applied on March 24, and Cocke's Prolific seed corn was planted March 31, 1928.

The work was done in three replications, the fertilizer having been applied on the list, harrowed in and planted. Each plot was prepared, planted and cultivated in the same way. Table No. 4B gives this work in detail, the figures reported giving the average of two replications with each test. The highest net profit was obtained when a high nitrogenous fertilizer was used in rather low amounts.

TABLE NO. 4B

Analysis Test—Corn

Lbs. material applied per A.			Analysis	Pounds ear corn per acre			Dollars per Acre		
Acid phos.	Nit. soda	Mur. pot.		Plot Yield	Check Yield	Increase	Value at $1 per bu.	Cost Fert.	Net Profit
No fertilizer				33.23					
300	160	100	8-4-8	41.5	32.43	9.07	9.07	8.51	.56
300	160	75	8-4-6	41.35	31.63	9.72	9.72	7.98	1.74
300	160	50	8-4-4	39.94	30.84	9.10	9.10	7.46	1.64
No fertilizer				30.05					
300	160	25	8-4-2	36.25	28.	8.25	8.25	6.93	1.32
300	160	0	8-4-0	36.66	25 95	10.71	10.71	6.41	4.30
300	320	50	8-8-4	45.41	23.91	21.50	21.50	11.62	9.88
No fertilizer				21.87					
300	240	50	8-6-4	40.00	24.26	15.74	15.74	9.54	6.20
225	160	50	6-4-4	35.10	26.65	8.45	8.45	6.90	1.55
150	160	50	4-4-4	35.73	29.05	6.68	6.68	6.33	.35
No fertilizer				31.45					
600	320	100	8-4-4	53.54	33.17	20.37	20.37	14.92	5.45
900	480	150	8-4-4	56.98	34.89	22.09	22.09	22.38	-29
1200	640	200	8-4-4	61.04	36.61	24.43	24.43	29.84	-5.41
No fertilizer				38.33					

LESPEDEZA—1928

Lespedeza as a pasture and hay crop has given excellent results here on the station. In wet years it makes a wonderful yield of hay, but in hot dry summers, especially when grown on

hill land, it frequently is badly damaged, making very little hay. It is one of the most satisfactory that we have for pastures.

In 1927 four varieties of lespedeza and seed was sent here from A. & M. College, and from the experiment station at McNeil. These varieties were planted including one other variety which was our home-grown lespedeza. A poor stand was obtained and this was not cut for hay in order that the seed would mature and a better stand be obtained for this year. Each of the five varieties came up to a perfect stand, and an exceptionally good yield was obtained. The varieties and yield are as follows: Kobe, McNeil, 5100 pounds per acre; Kobe 4500 pounds per acre; Kobe 04479, 3840 pounds per acre; Korean 49027, 2760 pounds per acre; Home-grown, 5100 pounds per acre. This lespedeza was fertilized May 21, 1928, at the rate of 400 pounds per acre of 8-4-4 plus 50 pounds calcium cyanamid.

SOYBEAN VARIETY TESTS

On May 19, seed of twelve varieties of soybeans were sent here by the Delta Branch Experiment Station. These varieties were planted on a single row test, each variety having been repeated four times. The land was fertilized May 4 with a home mixed 8-4-4 fertilizer at the rate of 500 pounds per acre.

These varieties were planted mainly for demonstration and not for seed or either hay production, as we did not have available land for this. Therefore we do not have any data on the yield. The varieties used in this test are as follows: Ebony, Delta No. 491, Tanloxi 483, Delta 488, Laredo, George Washington, Biloxi, Mammoth Yellow, Loxitan 483, Otootan, Tokio, and Midwest. The Ebony and Midwest showed up to be very poor varieties for this section. Loxitan 483 and George Washington makes a good growth but the quality of hay would not be very good as the size of stem is very large. The Laredo, Delta 491 and Delta 488 make excellent grades of hay due to the fact that the size of stem is small and the yield is good.

WORK WITH OATS

In the fall of 1927, just after harvesting the crops, oats were planted as a winter cover crop. Most of these oats are grazed through the winter, and plowed under in the spring, but some are allowed to mature in order to obtain some experimental data from them.

On 128 plats, one-twentieth acre each, tests were conducted

to show the results of analysis test, time applications, nitrogen sources test, and rate of application. The variety of oats planted was the Bayliss Rust Proof oats. The results are given in tables No. 5, 6, 7 and 8, and is self-explanatory, the weights given being pounds of oats in bundle per acre.

TABLE NO. 5

Analysis Test—Oats—1928

Lbs. per Acre	Analysis	Plot Yield	Check Yield	Increase
600	0-6-0	3225		
600	4-6-4	3550	3237	313
600	8-6-4	3675	3250	425
600	6-6-6	3425	3262	163
600	0-6-0	3275		
600	6-6-4	3550	3287	263
600	6-6-2	3400	3300	100
600	6-6-0	3300	3312	-12
600	0-6-0	3325		

TABLE NO. 6

Time Application of Fertilizer—Oats—1928

Amt. Fert. per Acre	Analysis	Time Application	Plot Yield	Check Yield	Increase
No fertilizer			1525		
600	6-6-0	March 7	3400	1719	1681
600	6-6-0	Feb. 20	3400	1913	1487
600	6-6-0	Feb. 7	3475	2107	1368
No fertilizer			2300		
600	0-6-0	March 7	3550	2107	1443
600	0-6-0	Feb. 20	3200	1913	1287
600	0-6-0	Feb. 7	3500	1719	1781
No fertilizer			1525		

TABLE NO. 7

Nitrogen Sources Test—Oats—1928

Lbs. per Acre	Sources	Analysis	Plot Yield	Check Yield	Increase
600		6-0-4	3475		
600	Am. Sulphate	6-6-4	4250	3429	821
600	Urea	6-6-4	4675	3383	1292
600	Cal. urea	6-6-4	4750	3338	1412
600	Cal. Nitrate	6-6-4	4650	3292	1357
600	Nitrate soda	6-6-4	4675	3246	1429
600		6-0-4	3200		

TABLE NO. 8

Rate of Application—Oats—1928

Lbs. per Acre	Analysis	Yields in Pounds per Acre		
		Plot Yield	Check Yield	Increase
No fertilizer		3150		
600	6-6-0	5350	3150	2200
400	6-6-0	4575	3150	1425
200	6-6-0	4025	3150	875
No fertilizer		3150		
600	0-6-0	4550	3037	1513
400	0-6-0	4225	2925	1300
200	0-6-0	3775	2812	963
No fertilizer		2700		

SORGHUM VARIETY TESTS

Fourteen varieties of grain sorghum were sent here from the Delta Branch Experiment station and planted in single rows, each variety being repeated four times. This land was fertilized at the rate of 600 pounds per acre of an 8-4-4 fertilizer and the seed planted June 22.

In harvesting these varieties the heads were cut after ripening and weighed and the yields are as follows calculated in pounds per acre: Milo Maize, 1,427; Shrock Kafir, 2,117; Shallu, 552; Chilltex, 1,146; Premo No. 2109, 2,005; Hegari, 1,289; Red Top Cane, 1,729; Golden Rod Cane, 869; Shrock Kafir, 1,157; Maize, 1,394; Sagrain 303, 2,195; Kafir Texas Blackhull, 894; Kafir Pink, 526; Milo Maize, 1,025.

The highest average yield and the best producer of grains was the Sagrain, with Shrock Kafir coming next. The Sagrain seemed to be much sounder and less affected by Fungus that attacked the heads.

SUGAR CANE

Co-operative work with the Department of Agriculture with sugar cane was continued. Forty-four varieties were included in the test. The seed cane for this work was originally supplied by the Department with the understanding that the results would not be published nor any cane be distributed to farmers until the Department had released the information and had satisfied themselves that the cane was worthy of being propagated for syrup or sugar production. Up to this time only four varieties

have been released, viz: Cayana, P.O.J. 234, P.O.J. 213, P.O.J. 36. After planting our 1929 crop, all of the above four varieties were given to farmers in small quantities. The general crop of the 40 varieties was made into syrup of very good quality.

REGULAR FERTILIZER WORK

For three successive years, beginning in 1925, this fertilizer test was conducted on the same plats, but due to wilt showing up so badly on some of the plats, it was decided to change, planting cotton where corn had been grown for three successive years. The corn having received the same fertilizer test as the cotton and the same number of times repeated, did not change any of the plats to different fertilizers heretofore used. Lone Star 65 cotton seed was planted on April 30, and a poor stand was obtained, due to damping off. The results show a very small net gain due to seasonal conditions as mentioned elsewhere in this circular, as well as poor stands and high infestation of weevils the latter part of the season. Table No. 9 gives the results of this work in detail, each results reported being the average of triplicate tests.

TABLE NO. 9

Analysis Test—Moody Field—Poplarville—1928

Lbs. Material Applied per A.			Analysis	Lbs. Seed Cotton per Acre		Dollars per Acre			
Acid Phos.	Nit. Soda	Mur. Pot.		Plot Yield	Check Yield	Increase	Value of Increase	Cost of Fert.	Net Gain
No fertilizer				697.5					
300	160	100	8-4-8	834.75	630.18	204.57	12.27	8.51	3.76
300	160	75	8-4-6	998.25	562.87	435.38	26.12	7.98	18.14
300	160	50	8-4-4	944.25	495.56	448.69	26.92	7.46	19.46
No fertilizer				428.25					
300	160	25	8-4-2	872.25	413.07	459.18	27.55	6.93	20.62
300	160	0	8-4-0	771.75	397.88	373.87	22.43	6.41	16.02
300	320	50	8-8-4	837	382.69	454.31	27.25	11.62	15.63
No fertilizer				367.5					
300	240	50	8-6-4	496.5	387.94	108.56	6.51	8.71	2.20
225	160	50	6-4-4	550.5	408.38	142.12	8.52	7.35	1.17
150	160	50	4-4-4	553.5	428.82	124.68	7.48	6.33	1.15
No fertilizer				449.25					
600	320	100	8-4-4	1155	540.94	614.06	36.84	14.92	21.92
900	480	150	8-4-4	1326	632.63	693.37	41.60	22.38	19.22
1200	640	200	8-4-4	1525.5	724.32	801.18	48.07	29.84	18.23
No fertilizer				816					

WINTER COVER CROPS

Of the five winter legumes planted on cotton land all were failures except monantha vetch and Austrian winter peas, the others having been almost totally destroyed by cold weather. The results with cotton after these two crops is given in Table No. 10.

TABLE NO. 10

Winter Legumes as a Nitrogen Source Under Cotton and the Effect on the Control of Wilt—1928

Legumes	Lbs. Fert. Used per A.	Analysis	Plot Yield per Acre	Check Yield	Increase	% Wilt Infest.
None	800	8-6-4	899			8.1
Monantha V.	800	8-0-4	945	902	43	15.7
No nitrogen	800	8-0-4	716	905	189	16.9
Aus. W. Peas	800	8-0-4	980	908	72	14
None	800	8-6-4	911			11.6

POTASH SOURCES TEST—MOODY FIELD

Twenty-four one-twentieth acre plats were used in this test, fertilized with a mixture of 800 pounds per acre of an 8-0-4, to which was added potash from various sources. Thirty-two pounds per acre of actual potash was added, using five common sources. Fertilizer was applied March 24, and Lone Star 65 cotton seed was planted April 30. Due to the seedlings "damping off" so badly after chopping it out, there was hardly a half stand by the middle of June. The percentage of wilt infestation was much higher than it has ever run in this particular field. The highest wilt infestation was on the check plats, it being 25%. The lowest percentage of wilt was where muriate of potash was used, the percent being only 13.3. Since there was not a uniform increase in yield, we do not give the table showing the results of this work.

COTTON VARIETIES

Eighteen varieties of cotton were tested out here in 1928. The preparation of the seed bed, fertilizer, planting, cultivation and poisoning was done the same way. The fertilizer was applied on March 22, using 600 pounds per acre of an 8-6-4 fertilizer. The varieties were planted on April 9, in single rows, each variety being repeated four times. Samples of each were taken

and sent to the Main Station, A. & M. College, for ginning and determination of lint percentage, length of staple and value per pound of the resulting samples. Table No. 11 gives the results of this work.

TABLE NO. 11

Cotton Varieties—Poplarville—1928

Variety	Lbs. per Acre		Lint Data		Cents per Pound	$ per A. Total	Rank in Value
	Seed Cotton	Lint	Per-centage	Length			
Cleveland 54	907	331.9	36.5	15/16	17.95	69.92	4
Cleveland Wilson	965	321.3	33.3	13/16F	17.20	66.85	5
Cleveland Piedmont	734	264.9	36.1	13/16F	17.20	54.00	15
Half & Half	664	278.2	41.9	¾F	17.20	54.79	14
Cook 1010	565	234.4	41.5	13/16	17.20	46.26	18
Acala 37	667	234.1	35.1	1	18.45	50.98	17
Rowden 40	663	239.3	36.1	15/16F	18.20	51.18	16
Miller	735	265.3	36.1	1	18.45	57.39	13
D. & P. L. 4	808	297.3	36.8	15/16	17.95	62.55	9
Delta Type Webber	810	268.9	33.2	1⅛	19.80	62.98	8
Delfos 910	846	285.9	33.8	1 3/32	19.65	66.25	6
Delfos 911	1026	346.7	33.8	1 3/32	19.65	80.35	1
Delfos 6102	981	332.5	33.9	1 1/16	19.40	76.17	2
D. & P. L. 6	809	292.0	36.1	1 1/32	19.05	64.93	7
Express 121	903	324.1	35.9	1 1/32	19.05	72.16	3
Lone Star 168	744	263.3	35.4	1 1/32	19.05	58.80	11
Lone Star 284	777	278.1	35.8	1 1/32	19.05	61.95	10
Lone Star 65	726	255.5	35.2	1 1/16	19.40	58.03	12

NITROGEN ANALYSIS TEST

Thirty-four one-twentieth acre plats were used in this test dividing it into two series using three replications in each series, one series being inoculated with wilt culture and the other uninoculated. Both series were prepared, fertilized, planted and cultivated in the same way. Cleveland 54 cotton seed was planted May 4, which was the third planting.

The basis of the fertilizer used uniformly over the 34 plats was 800 pounds per acre of an 8-0-4 to which was added the correct amount of nitrogen wherever nitrogen was due. The percentage of nitrogen varied from 4% to 10%. The results show that the highest average increase in yield per acre was

obtained from the use of an 8-6-4 fertilizer which gave an increase of 109.8 pounds per acre. Table No. 12 gives the results of this work in detail.

TABLE NO. 12

Nitrogen Analysis Test—Cotton—1928

Treatment per Acre		Pounds Seed Cotton per Acre			Wilt Infection
Pounds	Analysis	Plot Yield	Check Yield	Increase	Percent
800	8-0-4	530.5			2.2
800	8-4-4	568.5	542.1	26.4	2.6
800	8-6-4	663.5	553.7	109.8	1.6
800	8-8-4	639.5	656.3	74.2	1.3
800	8-10-4	671	576.9	94.1	2.8
800	8-0-4	588.5			3.8

EFFECTS OF POTASH FERTILIZER ON COTTON WILT

The very apparent effects of potash fertilizers in cotton production in the series of plats listed as "Old fertilizer tests," led to the extension of this line of work in 1927. In 1928 a co-operative agreement was entered into between the N. V. Potash Export, N. Y. and the Mississippi Experiment Stations by which agreement the above company agreed to furnish funds to employ an additional assistant at the South Mississippi Experiment Station to carry on additional experiments in determining

TABLE NO. 13

Effects of Potash Fertilizers on Cotton Wilt—1928—Neal Field

Treatment per Acre			Increase Lbs. Seed Cotton per Acre 600 8-6-0 as Zero			
Lbs. fert. Used	Analysis	Source of Potash	Yield per Acre	Increase 1928	Increase 1927	% Wilt Infection 1928	% Wilt Infection 1927
No fertilizer			405	-95	-323	24	24.3
600	8-6-0		500			25.1	23.6
600	8-6-8	KCL	677	177	448	14	16.0
600	8-6-8	K2SO4	649	149	290	8.9	6.0
600	8-6-8	D. Manure Salt	718.5	218.5	367	17	20.0
600	8-6-8	Kainit	757.5	257.5	424	4.6	5
600	8-6-4	KCL	632	132	347	13	5.4
600	8-6-10	KCL	583.5	83.5	403	16.7	7.7
600	8-6-12	KCL	543	43	288	221	16.3

the value of potash fertilizers in controlling wilt and rust in cotton.

There seems to have been a decided influence in the potash applications on the presence of wilt as determined by an examination of 300 stalks in each plat.

CO-OPERATIVE FERTILIZER TESTS WITH COTTON

This station continued the co-operative fertilizer tests in three south Mississippi counties, namely: Pike, Forrest and Lamar. In each instance, we have had the co-operation of both the county agents and the owners of the farm on which these fertilizer tests have been carried on. For the third year in succession this work was done in Pike county, co-operatively with County Agent A. J. Flowers, and on the farm of Mr. G. H. Alford. The fertilizer was distributed March 31, with the assistance of E. B. Ferris, formerly assistant director of this Station, and W. W. Welborne, the variety of cotton planted being Half & Half, with the report of a fairly good stand. There were only three replications used in this test. Table 14 gives the results of this work in detail.

TABLE NO. 14

Analysis Test—G. H. Alford—Pike County—1928

Lbs. Material Applied per A.			Analysis	Lbs. Seed Cotton per Acre			Dollars per Acre		
Acid Phos.	Nit. Soda	Mur. Pot.		Plot Yield	Check Yield	Increase	Value of Increase	Cost of Fert.	Net Gain
No fertilizer				480					
300	160	100	8-4-8	1290	438	852	51.12	8.51	42.61
300	160	75	8-4-6	1270	395	875	52.50	7.98	44.52
300	160	50	8-4-4	1210	352	858	51.48	7.46	44.02
No fertilizer				310					
300	160	25	8-4-2	1000	325	675	40.50	6.93	33.57
300	160	0	8-4-0	1070	340	730	43.80	6.41	37.39
300	320	50	8-8-4	1270	355	915	54.90	11.62	43.28
No fertilizer				370					
300	240	50	8-6-4	1460	397	1063	63.78	9.54	54.24
225	160	50	6-6-4	1160	425	735	44.10	6.90	37.20
120	160	50	4-4-4	1160	453	707	42.42	6.33	36.09
No fertilizer				380					
600	320	100	8-4-4	1830	525	1305	78.30	14.92	63.38
900	480	150	8-4-4	2090	570	1520	81.20	22.38	68.82
1200	640	200	8-4-4	2190	615	1575	94.50	29.84	64.66
No fertilizer				660					

This was the fourth successive year that this fertilizer test has been conducted in Forrest county, in co-operation with County Agent W. M. Seller, and on the farm of Mr. T. E. McCardle. The fertilizer was applied on March 19, and planted to Half & Half cotton seed on April 17. This work was done in four replications, and Table No. 15 gives it in detail. The net gains show up very badly, but this can be attributed to adverse weather conditions and boll weevils. Mr. McCardle reports that he had the sorriest crop of cotton this year that he has ever had in the past 37 years.

TABLE NO. 15

Analysis Test—T. E. McCardle—Forrest County—1928

Lbs. Material Applied per A.			Analysis	Pounds Seed Cotton per Acre			Dollars per Acre		
Acid Phos.	Nit. Soda	Mur. Pot.		Plot Yield	Check Yield	Increase	Value of Increase	Cost of Fert.	Net Gain
No fertilizer				294					
300	160	100	8-4-8	346	289	57	3.42	8.15	-4.73
300	610	75	8-4-6	335	284	51	3.06	7.98	-4.92
300	160	50	8-4-4	319	280	39	2.34	7.46	-5.12
No fertilizer				275					
300	160	25	8-4-2	366	261	105	6.30	6.93	- .63
300	160	0	8-4-0	346	247	99	5.94	6.41	- .47
300	320	50	8-8-4	331	233	98	5.88	11.62	-5.74
No fertilizer				219					
300	240	50	8-6-4	319	230	89	5.34	9.54	-4.20
225	160	50	6-4-4	289	241	48	2.88	6.90	-4.02
150	160	50	4-4-4	289	253	35	2.16	6.33	-4.17
No fertilizer				264					
No fertilizer				292					
600	320	100	8-4-4	502	291	211	12.66	14.92	-2.26
900	480	150	8-4-4	598	290	308	18.48	22.38	-3.90
1200	640	200	8-4-4	679	299	391	23.46	29.84	-6.38
No fertilizer				287					

In Lamar county in co-operation with County Agent C. W. Carroway, and on the farm of Mr. O. J. Pearce, we conducted this same fertilizer test, using only three replications. Due to excessive rainfall throughout the summer, and large infestations of boll weevil, there was not a uniform increase in yield obtained from any of these plats and we do not give the summary table showing the results of this work.

POTASH SOURCES TEST

There were seventeen one-twentieth acre plats used in this test which included only four sources of potash. These sources were muriate of potash, Kainit, potassium sulphate and sulphate of potash and magnesia. In this work all plats were fertilized uniformly with an 8-6-0 fertilizer at the rate of 800 pounds per acre and 32 pounds per acre of actual potash applied from the several sources of each. The fertilizer was applied March 22 and Lone Star 65 seed cotton was planted April 3. But due to a late spring and big rains, this cotton was planted over the third time which was on May 4. The variety of cotton being Cleveland 54. This was the first year that fertilizer experiments had been conducted on this land. Table No. 16 gives this work in detail, each result reported being the average of triplicate test.

TABLE NO. 16

Potash Test—Cotton—1928

Lbs. Material per A.	Analysis	Sources	Lbs. seed cotton per A.			% Wilt Infest.
			Plot Yield	Check Yield	Increase	
800	8-6-0		650		-	2.1
800	8-6-4	Muriate	570	645	-75	2.1
800	8-6-4	Potash Sul.	585	640	-55	2
800	8-6-4	Kainit	562	636	-74	1.1
		D. M. Salt.	590	631	-41	1.5
800	8-6-0		626		-	3.3

MURIATE OF POTASH TESTS

Twenty-one one-twentieth acre plats were used in this test, and the various analyses were used. The percentage of potash running from 8-6-0 which was used as a check, up as high as an 8-6-14, using at the rate of 800 pounds of fertilizer per acre. This being the first time that the land has been in cultivation for the past two years, the plats were thoroughly inoculated with wilt culture prior to the planting of the cotton in order to be sure the wilt germ was present in the soil.

The planting of this cotton was one month late, due to the fact that this cotton was planted the third time before getting a uniform stand, late spring and big rains being the causes. The results are given in Table No. 17 which shows that the average percent wilt infestation was the lowest when fertilized

with an 8-6-8 fertilizer and the second lowest wilt infestation when fertilized with an 8-6-10 fertilizer. Although the highest increase in yield per acre was with an 8-6-4 fertilizer, with only 2.8% wilt infestation, which is only .4% higher in wilt infestation than the lowest.

TABLE NO. 17

Muriate of Potash Analysis Test for Control of Cotton Wilt—1928

Lbs. per A.	analysis	Lbs. seed cotton per A.			% Wilt Infest.
		plot yield	check yield	increase	
800	8-6-0	462			5.1
800	8-6-4	555	470	85	2.8
800	8-6-8	525	478	47	2.4
800	8-6-10	502	486	16	2.5
800	8-6-0	495			8.5
800	8-6-12	515	488	27	3.2
800	8-6-14	610	482	128	4.0
800	8-6-0	476			4.0

SOIL FERTILITY TEST—COTTON

This work was started here several years ago to determine the effects of three common summer legumes grown alone and with corn, as compared with corn alone. In 1927 the three common legumes and corn were planted and for this year a crop of cotton was planted. There are 32 plats in the experiment, each plat receiving the same amount of fertilizer, which was at the rate of 600 pounds per acre of an 8-4-4 home mixed fertilizer, Lone Star 65 cotton seed was planted on May 1, which was the third time. This year results show that cotton following corn and velvet beans made the highest yield, corn and soybeans making the second highest yield. The results are not what they should have been due to adverse weather conditions and a high infestation of boll weevil the latter part of the season, and for that reason we do not give the summary table showing the results.

WILT RESISTANT VARIETIES

The wilt resistant varieties test conducted included only six varieties. All seeds used in this test had to be ordered from some pedigreed seed company and we were unable to get more than six varieties. In this test the varieties were planted in single rows, each variety being repeated five times. The basis

of the fertilizer used uniformly on this test, was 600 pounds per acre of an 8-6-4 fertilizer, using ammonium sulphate as the source of nitrogen. Table No. 18 gives the results of the percentage of wilt infestation in each.

TABLE NO. 18

Wilt Resistant Varieties—Cotton—1928

Varieties	Lbs. per A.	analysis	yield per A.	% Wilt Infest.
Cleveland 54	600	8-6-4	451	1
Miller	600	8-6-4	499	1.2
Rhyme's Cook	600	8-6-4	300	1.4
Trice	600	8-6-4	559	3.2
Super Seven (Strain 5)	600	8-6-4	466	2.8
Lightning Express (Strain 7)	600	8-6-4	583	3.4

FACTORY MIXED VS. HOME MIXED FERTILIZERS UNDER COTTON

This work was done on 25 one-twentieth acre plats, where corn had been grown for the past two years, with this same fertilizer test. In this work we are comparing three factory mixed fertilizers with home mixed fertilizers furnishing the same amount of plant food. The home mixtures used were made by mixing superphosphate, nitrate of soda, and muriate of potash in the proper proportions to furnish the same plant food as would be supplied by the factory mixed fertilizers. Fertilizer was applied at the rate of 600 pounds per acre on March 28. This was planted on May 4, Cleveland 54 being the variety planted.

The results show very small gains, due to seasonal conditions. Table No. 19 shows the average results of this work, the averages being of triplicate tests in each instance.

TABLE NO. 19

Factory Mixed vs. Home Mixed Fertilizer—Cotton—1928

Lbs. Material Applied per Acre		analysis	Lbs. of seed cotton per acre		
Factory Mixed	Home Mixed		plot yield	check yield	increase
No fertilizer			677		
600		8-4-4	885	702	183
	600	8-4-4	843	727	116
600		8-5-4	838	752	86
No fertilizer			777		
	600	8-5-4	778	757	21
600		10-5-3	875	736	139
	600	10-5-3	815	716	99
No fertilizer			695		

ADDITIONAL TOP DRESSING WITH MURIATE OF POTASH

The purpose of this additional muriate of potash test is to determine the effect that a side dressing of muriate has on the control of cotton wilt and rust.

Twenty-one one-twentieth acre plats were used in this test. The basis of the fertilizer used uniformly over these plats was at the rate of 800 pounds per acre of an 8-6-4 home mixed fertilizer, using as the mixture, superphosphate, nitrate of soda and muriate of potash, which was applied March 2, 1928, and was inoculated with wilt culture March 27. The variety of cotton planted on May 4 was Cleveland 54. Additional amounts of muriate of potash were applied July 3, running from 50 pounds per acre up to 250 pounds per acre, as shown in Table No. 20.

TABLE NO. 20

Additional Top Dressing with Muriate of Potash—1928

Lbs. per A.	analysis	Additional Amount of Potash Added	Lbs. seed cotton per A.			% Wilt Infest.
			Plot Yield	Check Yield	increase	
Check			630		-	2.8
800	8-6-4	50 lbs.	615	635	-20	3.9
800	8-6-4	100 lbs.	605	640	-35	2.3
800	8-6-4	150 lbs.	617	645	-28	3.4
Check			649		-	4.8
800	8-6-4	200 lbs.	690	691	-1	3.4
800	8-6-4	250 lbs.	717	733	-16	3
Check			776		-	2.5

HIGH ANALYSIS VS. LOW ANALYSIS FERTILIZER

On 21 one-twentieth acre plats, high and low analysis fertilizers are being tested. This was the second successive year that this test has been conducted on this land, varying the fertilizer analysis slightly. In making the low analysis fertilizer to be compared with the high analysis, superphosphate, nitrate of soda, and muriate of potash were used. Six hundred pounds per acre of the home mixed 8-4-4 fertilizer were used as a check, and this furnished the same amount of phosphorus, nitrogen, and potash as was contained in 160 pounds of nitrophoska, analyzing 30-15-15. Three hundred twenty pounds of a 15-5-5 factory mixed fertilizer was compared with 600 pounds of an 11-2-3 fertilizer and 300 pounds of a 20-16½-0, or Ammophos, was compared with 400 pounds of a factory mixture analyzing 12-6-6. The fertilizer was applied March 28, and planted to Cleveland 54 cotton seed on May 4. Table No. 21 gives the results of this work in detail, the figures given being the averages of triplicate tests in each instance.

TABLE NO. 21

High Analysis vs. Low Analysis Fertilizers—Cotton—1928
Rate 600 Lbs. per Acre.

Amount Fertilizer per A.	Analysis	Yield per Acre
600	8-4-4	664
160	30-15-15	740
600	11-2-3	647
320	15-5-5	600
400	12-6-6	595
320	20-16½-0	595

SUPERPHOSPHATE (ACID PHOSPHATE) VS. RHUM'S PHOSPHATE

Rhum's phosphate is probably somewhat different from the phosphate rock formerly used by the Station. It is a high grade of rock testing 32%. This making twice more available phosphorus per hundred pounds of the Rhum's phosphate than in the same amount of superphosphate. It is finely ground, 80% passing through a 300 mesh screen.

Fifteen one-twentieth acre plats were used in this test. A basal mixture of an 0-4-4 fertilizer at the rate of 600 pounds per acre was used, with the additional amount of superphosphate to bring the analysis up to an 8%, which was used as a check.

The Rhum's phosphate was added to the 0-4-4 fertilizer at the rate of 300 pounds, 400 and 600 pounds per acre. Three hundred pounds of Rhum's phosphate gave a yield of 47 pounds greater than 300 pounds of superphosphate, while 400 and 600 pounds of Rhum's both gave smaller yields than were produced by 300 pounds of superphosphate. We consider the results as inconclusive. Table No. 22 gives the results in detail, the figures being the average of triplicate tests in each instance.

TABLE NO. 22

Superphosphate (Acid Phosphate) vs. Rhum's Phosphate—Cotton—1928

Pounds Material Applied per Acre				Pounds Seed Cotton per Acre		
Super. Phos.	Rhum's Phos.	Nit. Soda	Muriate Potash	Plot Yield	Check Yield	Increase by Rhum's Phosphate
300		160	50	617		
	300	160	50	672	625	47
	400	160	50	630	633	- 3
	600	160	50	607	642	-35
300		610	50	650		

ORGANIC NITROGEN SOURCE TEST

In this work, three replications were used, making the sum of 25 one-twentieth acre plats. All plats receiving the equivalent of 600 pounds per acre of an 8-0-4 fertilizer with the nitro-

TABLE NO. 23

Organic Nitrogen Sources Test—Cotton—1928

Lbs. per Acre	Analysis	Sources of Nitrogen	Lbs. of Seed Cotton per Acre		
			Plot Yield	Check Yield	Increase
600	8-0-4		667		
600	8-4-4	Nitropo	708	649	59
600	8-4-4	Fish scrap	730	630	100
600	8-4-4	Tankage	680	611	69
600	8-0-4		592		
600	8-4-4	½ Fish scrap ¼ NANO 3	700	637	63
600	8-4-4	½ Tankage ½ NANO 3	820	682	138
600	8-4-4	Cal. Nitrate	872	727	145
600	8-0-4		772		

gen plats receiving 24 pounds of actual nitrogen per acre. This fertilizer was applied on March 29, and Cleveland 54 cotton seed was planted May 4. The results show very small increase. The same thing may be said about the effects of the weather on these yields as has been said elsewhere in this circular. This cotton was poisoned three times against the boll weevil and while these got so bad towards the latter part of the season, the low yield was due largely to adverse weather conditions rather than to the weevils. Table No. 23 gives the results of this work in detail, taking the averages of the three plats in each instance.

SEED TREATMENT TEST

The purpose of this experiment is to test out the effect that the different organic mercury has on the control of "damping off" and also the control on cotton wilt. The seed treatment test conducted in this experiment includes eleven different organic mercury treatments. Dr. D. C. Neal, formerly Plant Pathologist of A. & M. College, treated Lone Star 65 cotton seed with the various organic mercury treatments and sent the seed here to be planted. The seeds were planted on April 13, using single rows. Each treatment was replicated five times and on the fifth repli-

TABLE NO. 24

Organic Mercury Treatment for Cotton—1928

Organic Mercury Used	Lbs. Fert. Used	Analysis	Pounds Seed Cotton per Acre			% Wilt Infest.
			Plot Yield	Check Yield	Increase	
Check	600	8-6-4	348			11.1
Corona Merko	600	8-6-4	445	337	108	13.2
Special Bayer Dust	600	8-6-4	352	326	26	12.7
Spe. Bayer D. 6x3%	600	8-6-4	380	316	64	9.1
Check	600	8-6-4	305			9.1
Semesan Jr.	600	8-6-4	391	329	62	9.9
Semesan	600	8-6-4	428	353	75	10.6
KI. B. Dupont	600	8-6-4	428	377	51	13.4
Check	600	8-6-4	401			11.8
K. I. C. Dupont	600	8-6-4	442	394	48	11.2
Iodine Bentonite	600	8-6-4	445	386	59	10.3
Iodine Keiselguhr	600	8-6-4	487	379	108	9.3
Check	600	8-6-4	372			12.3
Dipdust	600	8-6-4	451	383	68	7.4
Usuplum	600	8-6-4	431	394	37	9.7
Check	600	8-6-4	405			11.6

cation the seed were planted by hand, placing only five seed in a hill, every 12 inches apart. Due to a second planting we were unable to get counts on the damping off. The basis of the fertilizer used uniformly on this test was 600 pounds per acre of an 8-6-4 fertilizer, using ammonia sulphate as the source of nitrogen. Table 24 gives the results in detail.

NITROGEN SOURCES TEST

This test was conducted on the same land for three successive years, starting in 1925. It was decided to rotate with corn, this year using the same nitrogen source test as have been used under cotton, and since there was no available land nearby, this test had to be started in another field that had not been in cultivation for the past two years.

There were 34 one-twentieth acre plats used in this test, testing seven sources of nitrogen. In this work all plats were fertilized uniformly, with 600 pounds per acre of an 8-0-4 fertilizer and 36 pounds of actual nitrogen applied from the seven sources to each plat receiving it. The fertilizer was applied on March 27, and Cleveland 54 cotton seed planted on May 4. The results show a small increase which can be attributed to adverse weather conditions. Table No. 25 gives the results of this work in detail.

TABLE NO. 25

Nitrogen Sources Test—Cotton—1928

Lbs. per Acre	Analysis	Sources of Nitrogen	Pounds Seed Cotton per Acre		
			Plot Yield	Check Yield	Increase
600	8-0-4		538		
600	8-6-4	Nitrate soda	489	510	-21
600	8-6-4	Am'onium Sul.	547	482	65
600	8-6-4	Cal. Cyanamid	607	455	65
600	8-0-4		427		
600	8-6-4	Cal. Nitrate	478	448	30
600	8-6-4	Urea	605	470	135
600	8-6-4	Cal. Urea	655	491	164
600	8-6-4	Leunasalpeter	577	513	64
600	8-0-4		535		

REPORT OF HORTICULTURAL WORK AT SOUTH MISSISSIPPI EXPERIMENT STATION FOR 1928

By W. S. Anderson, Horticulturist.

The investigations in Horticulture at this station as conducted since the beginning of the department may be grouped under the following headings (1) Plant Selection Work; (2) Fertilizer Experiments; (3) Variety Experiments; (4) Nematode Control Experiments.

PLANT SELECTION WORK

Sweet Potatoes: Mention has been made in previous reports for this station about work that has been done in an effort to bring up the producing ability of Nancy Hall sweet potatoes by mass hill selection. That is, for six years we have gone down the rows selecting all of the best hills and have isolated this selection from another one representing selections of all of the poor hills. An average of all of the increase due to this selection for six years is only 3%, which is not a favorable increase.

Cucumbers: Mention was made in our 1927 report of work started here that was co-operative with the American Pickle Company of Wiggins, Mississippi, in which we are attempting to improve the productivity, earliness and shape of pickle type of cucumbers by individual plant selection. The original stock seed for this work was secured from the state of Colorado through the Heinz interests. In 1927, two selections were made upon the vines' ability for producing cucumbers early. In 1928 these two lots of seed were planted in separate locations and after being carefully watched until fruits began to be seen, one of them was discarded on account of lateness. Of the other one a single vine was selected upon its ability to produce heavy crops early. This work will be continued again next year when more detailed attention will be given to the production of suitable shape cucumbers as well as retaining selections which set heavy crops early.

Blueberries: The work started here in 1921 with individual plant selection among something like 300 Florida blueberry plants, has been continued in 1928 with renewed interest. As has been mentioned in previous reports of this work an effort

has been made to isolate varieties by watching the habits of all of these plants during the fruiting season and noting whether the characteristics possessed were favorable ones. Three outstanding types have been selected and since their selection, have been watched through three fruiting crops. One of them produces round berries and ripens early, another makes an oblong berry which ripens early and a third one makes a round berry which ripens very late in the summer. The quality of the first two mentioned is good to excellent, while the late ripening type has only mediocre quality. The reason for selecting the late one was only for the purpose of getting ripe blueberries after all other berries are gone. We expect to take up the three plants representing the above mentioned selections this winter and divide each of them into as many plants as possible and make a new planting, including these three types only. From this planting it is expected that our Station will be in position within a few years to supply propagating material. In all of our work with this Florida type blueberry, we have found no occasion to combat insect pests or plant diseases and we are convinced that this fruit has an important place in South Mississippi horticulture.

Work was inaugurated this year which will determine the adaptability of this type of blueberry, for shipment to distant markets. A cardboard carton was made up which would carry 12 pints of this fruit. The carton was so made that it could be ventilated and the pint baskets used were ventilated parrafined paper boxes. Packages of blueberries put up in these cartons were sent to various places by express including Mississippi A. & M. College; Savannah, Georgia; Houston, Texas; Lyman, Mississippi, and Gulfport, Mississippi. Reports from all of these places tend to indicate that the berries carry exceedingly well when shipped in such a package. Work of this nature will be continued in 1929.

FERTILIZER TESTS

Tomatoes: The work begun here several years ago with fertilizers under tomatoes has been conducted again on the same plats of land in 1928. Leunasalpeter was used as the source of nitrogen this year instead of nitrate of soda, applying it so as to give the same amount of nitrogen per acre as has been used heretofore when nitrate of soda was applied. Marglobe, one of the wilt resistant varieties, was used again this year and a basal mixture of 600 pounds per acre of 8-4-4 home mixed fer-

tilizer was applied to all plats previous to applying the test mixtures. The land was prepared and the fertilizer was applied on April 4. A heavy rain fell on the night of April 5 and on the next day plants were taken from the cold frame and set in the field. The plants were pruned regularly, tied to stakes and topped when four clusters had formed. Although we had prospects of a very fine crop, our results look bad since excessive rains in the fruiting season practically ruined all of our top clusters. The best net gain this year was obtained from an application of 450 pounds superphosphate, 187 pounds leunasalpeter, and 100 pounds sulphate of potash, analyzing 6-4-4; the second best net gain was obtained from 8-4-0, or 600 pounds superphosphate and 187 pounds leunasalpeter; and the third best net gain was from 8-4-4 composed of 600 pounds superphosphate, 187 pounds leunasalpeter and 100 pounds sulphate of potash.

Since we have grown tomatoes on this land for four years in succession, it has become badly infected with wilt, causing some damage even to wilt resisting varieties. Due to this we are concluding the experiment on this land with this year and expect to start fertilizer tests of tomatoes on other land in 1929. We are therefore reporting herewith in Tables No. 26 and 27—a summary of four years work with this group of fertilizers. Since the work has been done in duplicate, the results are an average of eight trials of each fertilizer. Glancing at the figures in this table it seems that 1,200 pounds per acre of an 8-4-4 leads the list in point of net profit per acre where amounts per acre of this analysis was tested. These figures also show that when 1,200 pounds per acre of the various analyses was tested, an 8-6-4 gave the leading net profit, seconded by an 8-4-4, and with a 6-4-4 following, a close third. From these figures we would recommend the use of from 1,000 to 1,500 pounds per acre of either an 8-4-4 or 8-6-4.

Since there are usually many questions asked by tomato growers about the relationship between different amounts and kinds of fertilizers applied and the kinds of culls found in the production, it was decided to keep this year some records of the culls produced on our fertilizer tests. Careful counts were made of blossom-end rots, fruit rots, fruit cracks, and cat-faces, as well as recording the percentage of wilted plants and the total pounds of culls per acre. As all of these figures for this year are more or less negative, it is thought best not to publish any of them at this time.

TABLE NO. 26

Analysis Test, Tomatoes

4 Years — Application 1200 Pounds per Acre — 8 Trials

	Formula	Profit per Acre
	8-4-4	$132.37
Varying Phosphorus	6-4-4	130.02
	4-4-4	65.46
	8-8-4	82.58
Varying Nitrogen	8-6-4	138.72
	8-4-4	132.37
	8-4-8	86.13
	8-4-6	83.42
Varying Potash	8-4-4	132.37
	8-4-2	98.18
	8-4-0	108.72

TABLE NO. 27

Amounts per Acre Test of Fertilizers Under Tomatoes

4 Years — 8 Trials

Lbs. 8-4-4	Profit $
1200	132.37
1800	71.59
2400	56.51

Sweet Potatoes: The work with fertilizers under sweet potatoes started here in 1925 on rented land known as the "Moody Field," has been conducted again this year. As in the case of tomatoes, leunsalpeter was used as a source of nitrogen instead of nitrate of soda. The work, however, was not conducted on the same land as heretofore. In the same field experiments have been under way with fertilizers under cotton and corn using the same plat arrangement and same analyses and amounts per acre as has been used under sweet potatoes. A rotation of crops in the field this year placed the sweet potatoes following three years of cotton. The land was prepared and fertilizers applied on May 25 with plants of Porto Rico variety being set one foot apart in the row on June 5, which was a cloudy day and which was followed by a full day of rain. A perfect stand was obtained and a fine crop produced. The crop was harvested on November 8-10 inclusive, the sweet potatoes being graded and weighed on the plats as dug. Table No. 28

shows the details of results obtained from this experiment in 1928. These figures show that the highest net gain was obtained when 1,800 pounds per acre of an 8-4-4 was applied. Tables No. 29 and 30 show the average results of three years work with these fertilizers which, being done in three replications, represents an average of nine trials. Referring to this table one will note that when potash was varied, an 8-4-4 gave the leading net profit; when nitrogen was varied, an 8-4-4 gave the leading profit; and when phosphorus was varied an 8-4-4 also gave the leading net gain. Further reference to this table will show that when the different amounts per acre of an 8-4-4 were compared, 1,200 pounds led, with 1,800 pounds following closely as a second.

Strawberries: It will be remembered from our 1927 report that mention was made of an experiment started with fertilizers under strawberries early in that year. Although much care was given this field of strawberries during the summer of 1927 and the fertilizers applied early in the fall, our crop was almost a failure in the spring of this year. First of all, the plats were badly damaged by hogs during the winter, many of the plants being rooted up. Then in January, we had an unprecedented freeze which not only killed the leaves on all the plants but in some cases so injured the crowns that few buds were able to come out and set berries. On account of this no report is being published of the yields obtained from the tests in 1928, although a record is being kept of the production.

Peaches: In our 1927 report mention was made of our starting a fertilizer experiment under peaches, using the Belle of Georgia variety and a block of land containing approximately six acres which was set to trees of this variety in February of 1927. Also a legume experiment is combined with the fertilizer test, Austrian Winter Peas being grown between the trees each winter. This crop made excellent growth last winter and was turned under late in the spring. No seed were matured sufficiently to germinate. The amount of various fertilizers was increased this year by one pound per tree. Wonderful growth has been made by the trees in the orchard this year and unless some hazard overtakes the buds before next spring, it is expected that a nice crop of fruit can be harvested in 1929. Austrian Winter Peas were again planted in this orchard between the trees on the tenth of October and this crop will be turned under in the spring.

Pecans: The work started here in 1925, co-operative with

TABLE NO. 28

Sweet Potato Fertilizer Record—1928

Pounds Material Applied per Acre			Formula	Pounds Potatoes				Dollars per Acre		
				Plat Yield		Check Yield	Increase	Value of Increase	Cost of	Net
Super. Phos.	L. Sal. peter	Muriate of Potash		Nos. 1 & 2	No. 3	Nos. 1 & 2	Nos. 1 & 2	@ 2c	Fert.	Gain
No fertilizer				7453	2850	7453				
300	93.5	100	8-4-8	14982	2610	6816	8166	163.32	8.55	154.77
300	93.5	75	8-4-6	14557	2940	6181	8376	167.52	7.92	159.60
300	93.5	50	8-4-4	14146	2876	5546	8600	172.00	7.50	164.50
No fertilizer				4911	2700	4911				
300	93.5	25	8-4-2	13291	2548	4740	8551	171.02	6.97	164.05
300	93.5	0	8-4-0	11352	2785	4569	6783	135.66	6.45	129.21
300	187	50	8-8-4	14299	2710	4398	9901	198.02	11.70	186.32
No fertilizer				4227	2771	4227				
300	140	50	8-6-4	12231	3414	4253	7978	159.56	9.60	149.96
225	93.5	50	6-4-4	10101	3174	4279	5822	116.44	6.94	109.50
150	93.5	50	4-4-4	9225	3238	4305	4920	98.40	6.37	92.03
No fertilizer				4332	2309	4332				
600	187	100	8-4-4	15217	3246	4873	10344	206.88	15.00	191.88
900	280	150	8-4-4	16858	1919	5414	11444	228.88	22.50	206.38
1200	374	200	8-4-4	17612	1730	5955	11657	233.14	30.03	203.11
No fertilizer				6496	2218	6496				

TABLE NO. 29

Analysis Test—Sweet Potato Fertilizers—Moody Field

3 Years — Application 600 Pounds per Acre — 9 Trials

	Formula	Profit per Acre
	8-4-8	$ 92.90
	8-4-6	93.91
Varying Potash	8-4-4	101.74
	8-4-2	83.28
	8-4-0	43.18
	8-4-4	101.74
Varying Nitrogen	8-6-4	58.84
	8-8-4	84.88
	8-4-4	101.74
Varying Phosphorus	6-4-4	93.75
	4-4-4	71.11

TABLE NO. 30

Amounts per Acre Test of Fertilizers Under Sweet Potatoes—Moody Field

3 Years — 9 Trials

Pounds 8-4-4	Profit
600	$101.74
1200	120.78
1800	110.02
2400	98.08

Governor Bilbo, testing fertilizers under pecans, has been continued. We are very sorry, however, to report no crop again last year. These trees are the Stuart variety and all Stuarts have missed fruiting again this year in this section. The trees however, have made very satisfactory growths this year and it is hoped will set fine crops of nuts in 1929.

VARIETY TESTS

Fruits: The many observations of various fruit varieties have been continued in 1928 with peaches attracting major attention by producing enormous crops, especially certain varieties. In Table No. 31, we list all the varieties of peaches which bore fruit this year. This table shows the average pounds produced per tree. We might mention that one of our Hiley trees, eight years old, produced 607 pounds of fruit. All varieties bearing made peaches of good marketable size and were well colored for the variety. It will be noticed from the table that Hiley leads

TABLE NO. 31

Peach Variety Record—1928

Name	Age of Trees, Years	Date Began Ripening	Average Lbs. per Tree	Flesh Color	Stone Character
Mayflower	8	May 26	Few Fruits	White	Cling
Alexander	8	June 16	Few Fruits	White	Cling
Greensboro	8	June 16	28	White	Semicling
June Elberta	8	June 11	58	Yellow	Cling
Early Rose	8	June 18	43	White	Cling
Early Mamie Ross	8	July 2	294	White	Cling
Hiley	8	June 30	418	White	Free
Alton	8	June 30	135	White	Cling
Carmen	8	June 30	50	White	Cling
J. H. Hale	8	July 27	23	Yellow	Free
Slappy	8	June 30	271	Yellow	Free
Belle of Georgia	8	July 17	179	White	Free
Early Elberta	8	July 25	79	Yellow	Free
Elberta	8	July 27	13	Yellow	Free
Early Wonder	3	May 26	Few Fruits	White	Cling
Yellow Hiley	3	June 30	25	Yellow	Free
Captain Edes	3	July 26	14	Yellow	Free
Lizzie	3	Aug. 1	8	Yellow	Cling
Frank	3	July 26	40	Yellow	Cling
Brackett	3	Aug. 2	11	Yellow	Free
Gold Medal	3	July 26	Few Fruits	Yellow	Free

the list, which is usually the case, although in some years Belle of Georgia has made the highest record. Of the 35 varieties which are eight years old, we feel that for commercial use, we would recommend in extreme South Mississippi only Early Rose, Belle of Georgia, Hiley and Slappy. For the home orchardist we would add to that list Mayflower, Early Mamie Ross and possibly June Elberta and Greensboro. The varieties planted three years ago came into bearing this year and the table above referred to shows the productions from seven of those varieties. Three of the ten varieties did not bear. In this group are several yellow colored peaches which ripen rather late and which it has been hoped would be good ones to replace Elberta in South Mississippi. The latter variety still fails to bear sufficient crops to warrant its planting in this section.

The apple varieties are not showing up well. In the original planting there were 32 varieties and two trees of each variety. It will be recalled from previous reports of this work that several varieties have died out from fire-blight, while others continued

growing vigorously and bore crops. It seems that this year more diseases have developed on crops than ever before and the apple varieties here certainly suffered their part. There are now alive the following trees, two of Day, three of Red Astrachan, 2 Delicious, 2 Staymen Winesap, one Red June, one Golden Delicious, two each of Moore, Rambo and one each of Horse, King David, York, Kinnards' Choice, Fanny, and Hackworth.

The five trees we have of Pineapple pear bore their first heavy crop this year. The several varieties of pear which are being grown co-operatively with the office of Foreign Seed & Plant Introductions, are beginning to bear a few fruits. Some are going down under attacks of fire-blight while others show some resistance. Not enough is known yet about these new kinds to publish any information about them.

The several varieties of figs made excellent crops this year, but as usual the Celeste dropped much of its crop before ripening. At present it seems that Green Ischia leads the list where cultivation is practiced. In this connection it may be recalled from our 1927 report that we have started some tests of mulch culture on our fig variety orchard and that we are keeping the entire ground in this part of the orchard covered with oat straw, and are not doing any plowing at all in this section. This block includes Lemon, Magnolia and Celeste varieties. These varieties are also in the cultivated portion. At the end of two crops produced on the mulched area, we feel like saying that there is some advantage to this practice but hesitate to recommend it until we have made further studies.

The new varieties of various tree fruits introduced two years ago through the Bureau of Plant Industry including two Japanese Cherries, four Chinese jujubes, three plums and one each of Chinese Tung Oil and Chinese Evergreen Chinquapin, have made good growths in 1928. The chinquapin was killed back practically to the ground in January by a two-day occurrence of a temperature of 16 degrees F., but the roots were not injured and growth started from the stump early in the spring. The trees of this variety planted in a pasture near other trees and near a bog, have all died after making very little growth the first year.

Of the planting of some 35 varieties of bunch grapes in 1920, we have culled out for one reason or another all except Delaware, Muench, Herbemont, Ellen Scott, Lenoir and Delicious. These varieties are still making respectable crops annually. Be-

sides replanting certain of the original ones that died out, such as Niagara and Concord, we have filled the vineyard with other less common varieties which we had hoped could be grown in this section. Our muscadine varieties, James, Flowers, Thomas and Scuppernong, are still outstanding in their production as grown in a vineyard way, with annual pruning, cultivation and fertilizers. These varieties make from 50 to 75 pounds of grapes per vine each year without any attention to spraying. This group of grapes offers a wonderful opportunity for the small vineyardist who is not equipped to take care of the varieties that have to be sprayed regularly in order to produce fruit.

It will be recalled from our 1927 report that the satsuma orange planting here made excellent crops in 1927 in spite of the fact that we had a one-day minimum temperature of 16 degrees F. the previous winter. A freeze in January of 1928 at which the temperature went to 16 degrees F. for two days in succession so injured the leaves on these trees that from 95 to 100% of them dropped. Although blossom buds opened in the spring, very few fruits were held by the trees and the crop is therefore a failure for 1928. The wood of the trees, however, was not injured and excellent growth has been made this year. Of the two kinds of Kumquat, Nagami is apparently as hardy as satsumas, and Marumi more hardy. This variety bore fruit this year. The round orange varieties as well as the grapefruit varieties in this orchard were killed below the dirt mounds as well as the two lemon varieties, and although these several varieties have come out with good growth this year, we feel it quite safe to guard against planting any round orange, grapefruit, or lemon varieties in this latitude, except possibly a tree or two for home use and for novelty's sake.

The three varieties of briar berries, Van Fleet raspberry, Thornless dewberry, and Young dewberry are still showing up quite well. All three make quite respectable crops and are so resistant to small fruit diseases that they require no spraying. They are also all resistant to the cold winters we have had since planting them here. We feel that any home garden or home orchard is not complete until some of these berries are introduced but do not recommend the planting of either of them on a very large scale commercially. However, it would not be bad to have sufficient of these growing to supply whatever local demand that might arise. Especially is this true of the Young berry, which is a very fine market variety and which has shipping possibilities.

Of all the varieties of plums planted here in 1920, only one seems worth recommending and that is Munson, which has never failed to make a fine crop. We do not consider this variety worth growing to sell but it is a very fine home orchard variety. We planted two other varieties of plums two years ago and expect to introduce additional ones this winter in an effort to find some which will bear crops worthy of introducing the trees in commercial plantings.

Mention has been made in another part of this report of the test of Florida type blueberries. The work with this type has been a trial of their adaptability to the section as well as selection work. Early in 1926, there were planted seven varieties of northern type blueberries, which were obtained from the Whitesbog Nurseries at Whitesbog, New Jersey. This was the second planting of these varieties, a planting one year before having died in the summer of 1925. Accompanying the latter varieties were instructions from that nursery that we not fertilize or cultivate these blueberries for the first two or three years, but mulch the land around them heavily with leaves or straw. This was done and all of the varieties have lived and made slow growth except one, this being Cabot, which died in the summer of the first season. The other varieties in the list are as follows; Rubel, Sam, Pioneer, Harding, Grover, and Adams. None of these have set fruit, although all bloomed in the spring of 1928. Since those varieties are seemingly becoming accustomed to our climate, it is expected that under cultivation and fertilization in 1929, they should bear fruit.

Vegetables: This station has continued experiments in 1928 with many different strains of both Triumph and Irish Cobbler potatoes including both certified and uncertified kinds. The details of this work have already been published in Circular 80. This work was done co-operatively with the Raymond Branch Station, the Main Station at A. & M. College, and the Plant Pathology Department of the State Plant Board, and the results published co-operatively.

Work has been started this year testing several varieties of sweet potatoes not heretofore generally known in this section. About four years ago we accidently found some roots mixed with the seed stock of Porto Rico that had a purple skin and a flesh identical with Porto Rico. These roots were carefully sorted and bedded separately. Observations during the growing season showed considerable similarity between the vine of this

sweet potato and that of Porto Rico with the difference being that the former had darker colored stems and possibly shorter vines than the latter. An effort was made last year to get identification of this variety, if indeed it be a variety, and although specimens of the vines and roots were sent to Washington and the Norfolk, Va., Truck Station, we found out nothing more than that it is possibly a bud sport from Porto Rico. Tests of this sweet potato indicate that it produces as well or better than Porto Rico and keeps excellently well, while it has quality which compares favorably with Porto Rico. It was suggested by Professor James H. Beattie of the U. S. Department of Agriculture, that this sweet potato might be Creola, but when better specimens of the roots were furnished him, his decision was quickly changed. However, Professor Beattie supplied us with a few roots of the Creola variety and we supplied him with a bushel of our purple skin kind. No report has been received from Washington as to results they had with comparative trials of this kind, this year. In our tests, Creola made 6902 pounds per acre of marketable roots and 1980 pounds of those not marketable. These results also show that the purple skin one made 9,420 pounds of marketable potatoes and 3,338 pounds of culls. Professor Beattie supplied us with approximately 30 draws (plants) of 5 seedlings which have been developed by his department in recent years and which have promising possibilities. These are unnamed and are classified by the following numbers: 224, 220, 305, 1-32 and 194. All of these were set on June 6 in a very rich spot of land near a barnyard. When harvested the first week in November, all of these varieties appeared to have gone largely to vine and we experienced quite a lot of difficulty in removing the vines enough to be able to plow up the rows. No records were kept of the relative production of the various kinds, but all of the roots produced by each kind have been saved in storage for bedding in 1929 when it is expected we will include each of these in a check list of varieties.

With the information we now have, we recommend that the Porto Rico variety be used exclusively by commercial planters of sweet potatoes.

The work started here two years ago with several varieties of watermelons was planned for continuation in 1928 when 8 varieties were planted on March 24. Just as these varieties were germinating a heavy rain followed immediately by a freeze caused a total loss of stand. On April 16 the entire test was

planted over and we regret to report that other heavy rains destroyed the stand to such an extent that the experiment was considered a failure and no records were kept.

Continued observations are made every year, of the behavior of various garden vegetables planted here in a small plat of land set apart for such work. In 1928 we grew on this block in the spring, three varieties of spinach, 2 of cabbage, 2 of carrots, 2 of beets, 2 of onions and 3 of bush beans. Observations of these crops compared with those of previous years tend to indicate that King of Denmark spinach is by far better adapted than Virginia Blight-resistant or Bloomsdale. It seems that red Bermuda onions are much more likely to produce large roots than is Prize-taker. Good results have been obtained from plants and sets of the Bermuda. With beans, we have been testing Reuter's Full Measure, Burpee's Stringless, and the Giant Stringless Green Pod. As a spring crop we would choose between Full Measure and Burpee's Stringless, the former possibly having some advantages. As a fall crop, Full Measure is certainly the best of the three, as it seems to withstand our fall droughts better. In comparing Charleston Wakefield and Flat Dutch varieties of cabbage, it seems that both should be included in the home garden since the Flat Dutch stands more cold while the other heads much earlier. Crosby Eygptian beet seems much earlier than Blood Turnip, and we would plant it in the home garden. Comparing Danvers Half Long with Early Chantenay carrots it seems that the latter is decidedly the better for our use in home gardens.

NEMATODE CONTROL TESTS

Observations are being continued of the behavior of peach trees in the block set aside for studies of the effects of cultivation on nematode control. No results are ready to be published yet indicating the effects of sod, clean culture, or alternating culture on the control of this pest. The experiments with sod culture as a nematode control on figs was discontinued two years ago as no growth could be obtained where sod was allowed to grow around trees of this fruit. It will be remembered from our last year's report that work was started in the variety block of figs to determine what effect mulch culture would have upon this pest and part of this block is being kept heavily mulched. We are able to say little at this time in favor of mulching as a nematode control measure.

Bulletin 267 July, 1929

LANDSCAPE GARDENING

IN

HOME BEAUTIFICATION

BY

WELLINGTON KENNEDY

A thing of beauty is a joy forever—Keats.

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi

J. R. RICKS, Director.

LANDSCAPE GARDENING IN HOME BEAUTIFICATION

By Wellington Kennedy

Some one has said that in Europe the work of man adds to the beauty of the scenery, while in America, it usually makes a blot on it; but this is a rather unfair statement because Americans have a sense of beauty. A cultivation of our national artistic taste is what is needed. We have been worried with the practical struggle of developing our country and the aesthetic side has been neglected.

The logical place for a better appreciation of art to arise is in the home, and obviously we can look to Landscape Gardening for this. It is something that is with us always. It is the most universal way in which we can all practice and appreciate art. Landscape Gardening differs from the other arts in that in it we all create pictures of our own, besides enjoying the work of others. Instead of using paints and canvas, we use trees, shrubs, and flowers as the materials out of which our picture is produced.

This is a variable art. It may take years to complete a single picture. The materials we use change and if we do not know what the changes are to be, our pictures may be ruined. Perhaps you have seen the tall-growing Deodar Cedar misplaced by being put close by a house, right next to a sidewalk, or beneath a window.

All that can be pleaded for is a sense of good taste. Just because one cannot employ a Landscape Architect to plan his grounds is no excuse for not having a beautiful place. Many of the most charming homes have been the results of a loving interest by the owners who have wanted livable homes rather than merely houses in which to eat and sleep.

ARRANGEMENT OF PARTS FOR SMALL HOME GROUNDS

The average modern home in the South today is on a small area and the arrangement of parts and the allotment of space for such demand very careful consideration, for correct planning at this point means a simplification of all later steps. You all have probably seen and admired stately old mansions and perhaps wished that you could

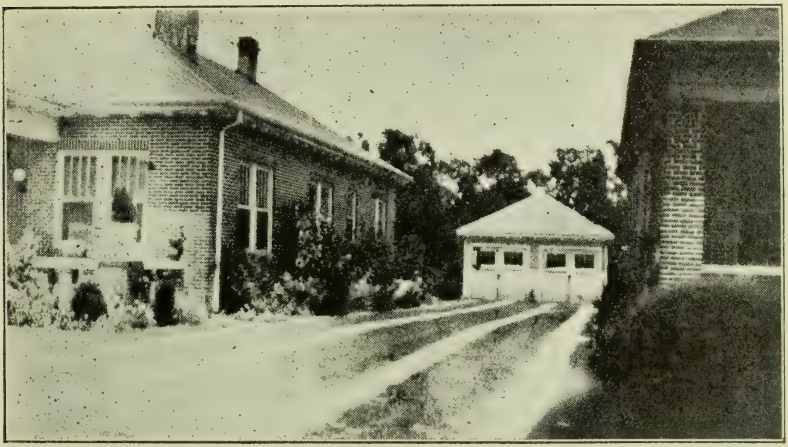
have such a beautiful place. However, the size of the canvas has never been measured of a great painting, and within the boundary of a modest place a delightful effect can be secured.

One should begin by planning the place as a whole, with perhaps a few details in mind. More careful planning is needed in small properties than in larger ones, because not a foot can be wasted. One must strive to produce the effect of spaciousness by eliminating all details that would detract from the main design or give a crowded, jumbled effect. It is easier to erase than transplant.

A suggestion for treating the area between houses. When possible this should be a cooperative plan.

The position of the house, as well as its general dimensions, determine the size of the front, side, and rear areas. In a built-up section, one cannot vary more than a few feet from the established building line without detriment to the appearance of the block and possible damage to the neighbor's property as well as to his own. Where there is no standard already established, the setback is generally one-third to one-half the lot width. Enough space is needed in front of every building to present one architectural unit, but beyond that, land is wasted and results are often unsatisfactory. A common following is that if one is to locate on a narrow street, a deep setback will give a spacious effect. However, deep lawns along a narrow street only

emphasize its narrowness. The front yard that is wider than it is deep makes a lot appear wider than it actually is, while the opposite effect results with a deep setback.



Where cooperation has resulted in a double garage. One driveway is sufficient.

It seems to be a convention to put the house squarely on the center line of the lot. This is unfortunate and very often means a great deal of waste space, because there is not a sufficient area on either side to be used for the development of a garden or expanse of lawn. If the house is placed to one side, there will still be room enough for an automobile drive on the narrow side, while on the other side an expansive and pleasing effect can be worked out because of the additional room.

There are no precise rules for the allotment of space in the home grounds, but the following are the three main areas to be found in any well planned property: The private area, including the family garden and recreational area; the public area, including the front lawn and reception area; and the service area, including the garage, vegetable garden, turncourt, chicken house, and similar utilitarian features.

This plan is structurally related to the design of any house with its front hall, living room, and kitchen, and each indoor area, as well as being similar in use to its outdoor counterpart, likewise connecting directly with it. In

a great part of the South, the prevailing winds in the sum-

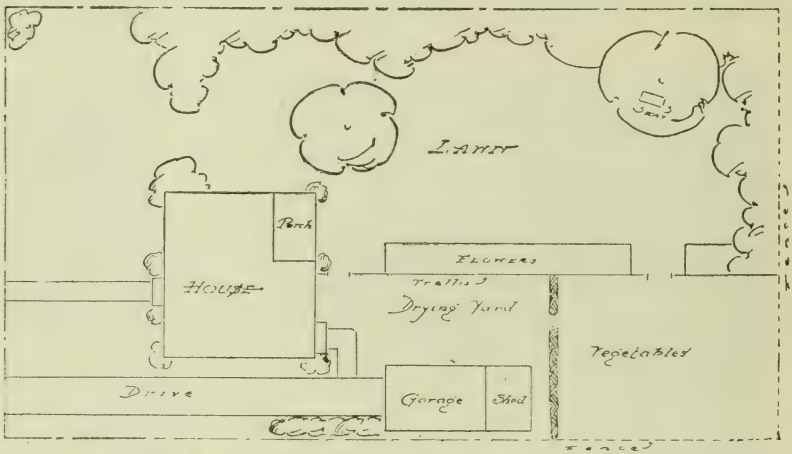


FIG. 1—AN ARRANGEMENT OF THE SMALL HOME GROUNDS

mer are from the Southeast. This should be considered in planning for the living rooms of the house. On that side of the house should be adjoined the most private and pleasingly developed part of the yard, which should be the largest division of the outdoor space. It has been the old American custom to plan a yard to be attractive only from the street, while the rear area remains a collecting place for junk. It often happens that when the backyard is developed, it is seriously lacking in privacy. Yards without any privacy receive little interest from their owners, as they cannot be used. Architectural barriers as trellises and walls will be necessary for privacy when there is no space for shrubbery borders or clipped hedges, for the same privacy is required as in the living rooms of the house. The smaller the lot, the higher and narrower the boundary must be.

It is much better to have a house with a low floor level and doors opening out directly on to the garden, for if it is easy for people to get into their own private grounds, they will go there, as we all like to be in pleasant surroundings. We must remember that a much sheltered setting is essential either for a homelike atmosphere or a garden background.

Formal design is undoubtedly the best to use in small areas. Straight lines on small lots express greater scale.

Sinuous, informal shrubbery borders are pleasing where there is sufficient room for their development, but the small place is basicly a collection of rectangles with the enclosures parallel or at right angles to the property lines, which, in themselves, generally enclose rectangles which are the home grounds.

A GOOD AUTOMOBILE ENTRANCE AND DRIVE.

The public area, or front yard, of the home grounds has been developed to the detriment of the other parts under the grand old American custom of making as big a show as possible to the public. But we do not exhibit the intimate details of our homes in the public reception hall; its size is kept to a minimum, and its furnishings are kept simple and dignified. This should be a guide in treating the front yard. Simple foundation plantings should be used; save garden-like features for the rear, for the location of the garden should not be in the front yard of a small lot. A meaningless curve in the front walk shows poor design. Pleasing curved walks are possible with houses of informal type of architecture and good sized lawns, but on the ordinary place, the house is essentially formal and the shortest distance between two points is the best. Every Southern home should include at least one good showing of flowers. In the "Land of Sunshine and Flowers" where we all love beautiful things, it is only natural that such should be the case.

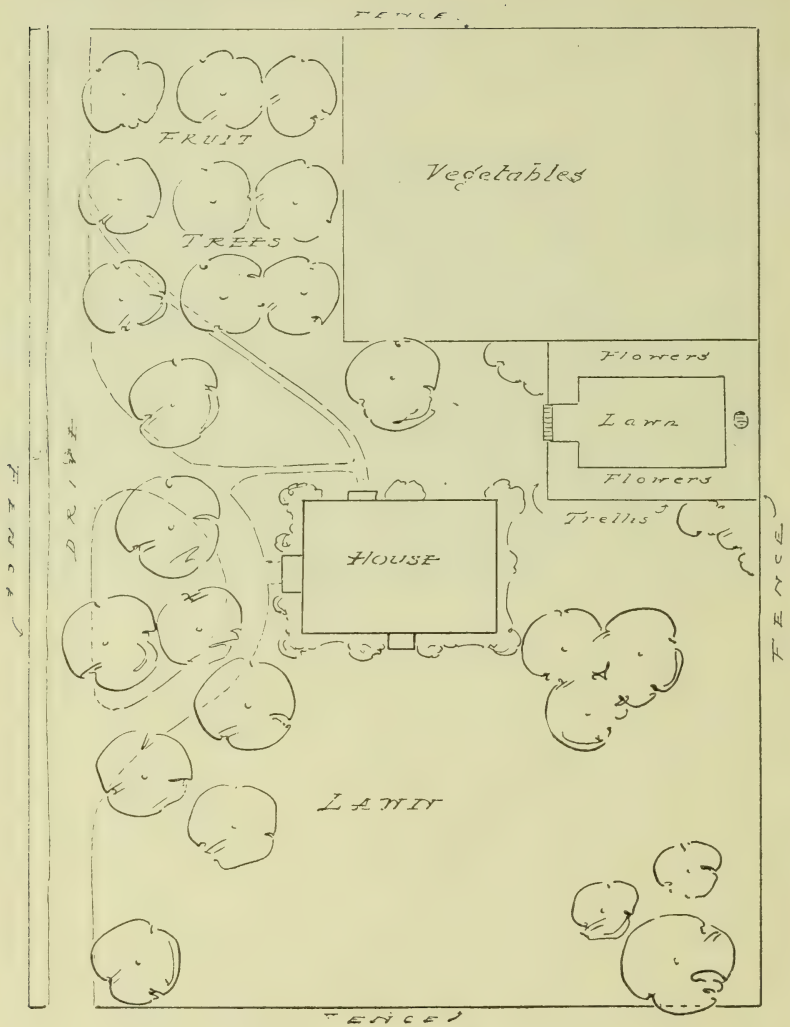


FIG. 2—A FARM HOME

The service yard should be carefully planned in order to reduce its space and at the same time allow for its convenience and neatness. It is here where the groceries will be delivered to the kitchen, the coal wagons will come, and, in fact, all manner of service be performed. It may in-

clude the garage, turncourt for automobiles, laundry yard, cut flower garden, cold frames, chicken house and runs, the compost pit and the like. The whole area should be definitely screened from the private area. Of course, one must often make the most of limited means and the clothes may be dried in the garden area, or all gardens combined into one. After all, we can do no more than make the best of our situations and let this be our guide in all our work.

It is a waste of land to put the garage at the end of the lot. It is less convenient in stormy weather, difficult to back out from if there is no way of turning the car around, and the extra land taken up with driveway could well be used for a garden, cold frames, or drying yard. Likewise, the garage looks much better if it is actually attached to or near enough to the house to be architecturally harmonious. A little extra effort in making the garage something more than a covering to keep off the rain will add greatly to the appearance of the place.

The planning of the average American home works out very simply in a logical way. The most of the grounds is devoted to private enjoyment, while at the same time, service has been provided as well as a front yard of ample proportion. The "domestic style," as it has been called, is the happy medium in home grounds design between the formal and national style in America. It expresses our best taste and needs and is here to stay as our greatest contribution to Landscape design.

FOUNDATION PLANTING

There is a practical as well as the recognized aesthetic value of Foundation Planting. Real Estate operators have been adopting the policy of "Landscaping" their developments because they realize that houses on well planned and executed grounds will sell much easier than houses perched on bare lots.

A little money expended on foundation planting will add greatly to the appearance of a house. A "little" is too often the word. We insist upon furnishing our interiors with the very finest, but economize when it comes to improving the grounds which provide the home atmosphere. All too often we have seen people spend twenty-five or thirty thousand dollars on a house and then set fifty dollars as the limit of expenditure on the grounds.

The general purposes of foundation planting will first be considered. They are:

1. To unite the building with the ground. A little touch of green acts as a binder; it ties the building more logically to the rest of the landscape.

2. To break up stiff architectural lines of the building. Even the architect, when he submits sketches of proposed buildings, recognizes this and adds foliage and shadows.

3. To soften colors. Even the most hideous results of the decorator's trade can be toned down by neutral greens. Shadows on a building give rest as well as interest.

4. To cover up offensive objects. It should not be the burden of landscape gardening to cover up the mistakes of others. The realization must come soon that landscape gardening is not a profession of "covering up" objects.

5. To secure privacy; to make a house homelike and livable. A foundation planting along a property line is the same idea.

A PLEASING DEVELOPMENT

There are three general types of foundation planting: (1) Informal (2) Formal (3) Semi-formal.

The informal planting is the most common with its sinuous shrubbery lines with bays and points. This is generally the most pleasing, but not necessarily so at all times. The accents, or more conspicuous and taller planting, are

at the angles of the house, with more neutral material between.

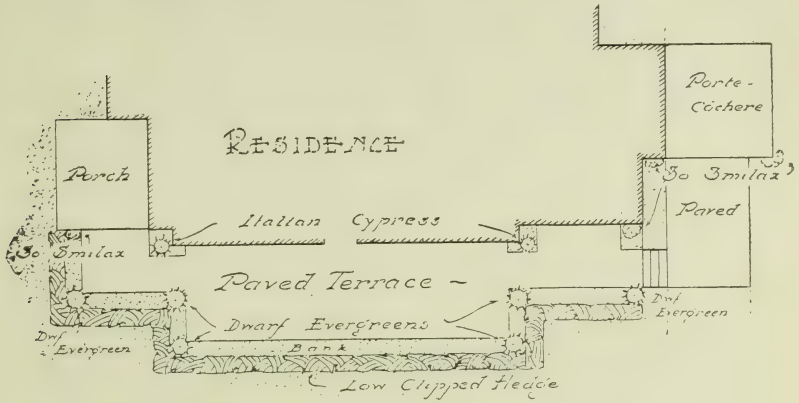
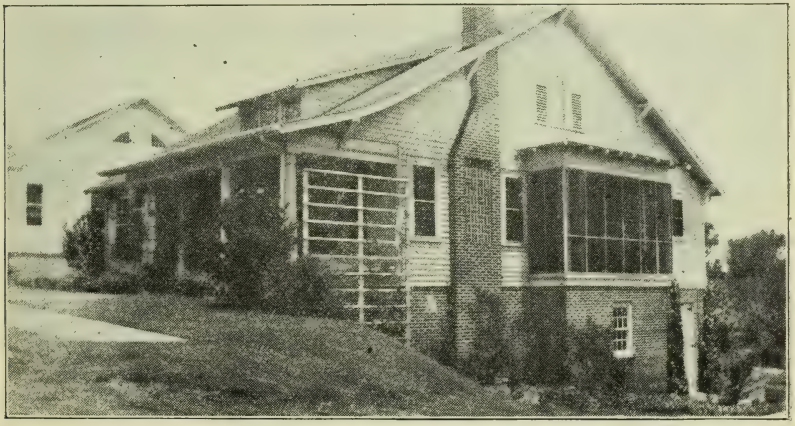


FIG. 3—FOUNDATION PLANTING FOR FORMAL TYPE OF HOUSE

Not enough consideration is given the formal planting. Where we have distinctly formal, stiff, architecture, a like treatment is required. A clipped hedge all aroung may compose the major part of a design.

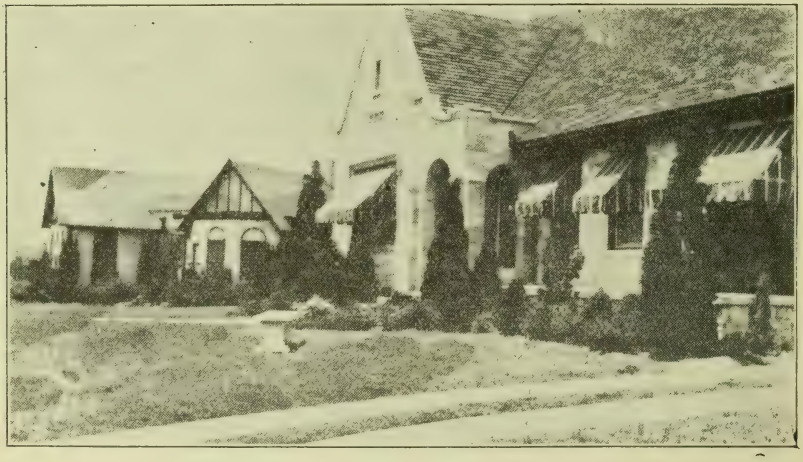
The semi-formal type seems to be the popular craze today. It is the wide use of formal evergreens in foundation groups. Some good work of this type has been done, but it has been probably stressed too much and already many people are turning from it.



A house designed for flat land misplaced by placing on a slope. A tall planting is needed on the low side.

The foundation plantings should be kept secondary to the building and the character of the building should suggest the type of foundation planting to be used, as well as supply the motive and be the guide for all that is done. If the house is Southern colonial, a very simple planting is best, using the old-fashioned shrubs that have long been associated with that type of architecture. With an informal English cottage type, we must plant differently. We should love plants, but remember that they are but an adjunct to architecture in foundation planting.

There are no hard and fast rules that can be set down for each place is a problem in itself. A few suggestions can be put in here, but they must be adjusted to one's own yard. Do not use the conventional hodgepodge, but have a sense of individuality and decide what ultimate effects you want and then find the plants to give these effects.



A SEMI-FORMAL PLANTING OF EVERGREENS.

We are composing a picture. The house, which we are featuring, supplies the keynote of the design. Try to use vegetation merely to soften, enframe, or add a touch of decoration. The foundation of the house is logical, so it is well to show it once in awhile. Keep the planting low beneath windows or where a view is to be saved. Over-planting is common. The spectacle of a little house surrounded with vast billows of foliage is everywhere to be seen.

Houses which set close to the ground need no planting except at the corners. Low growing plants may be used in between.

If there is a high foundation to the house, it is often well to raise the grade by putting a terrace in front of the house, and, if possible, all the way around. The closer the house fits the ground, the easier it will be to plant and the more satisfactory the results.

A scattering, haphazard arrangement of specimen plants is a very common fault. Don't go into a nursery, look around, and buy one specimen of every plant that catches your eye, and then, after you get home, try to straighten the mess out to make a respectable planting. The shrubs bought should be those that are called for as a result of a well considered plan on paper. It is a good rule to use three or more of one kind of shrubs together. We want effects,—masses,—not merely collections of individual specimens. The home is no place for a collection of horticultural curiosities. A freak show belongs elsewhere. Do not use your favorite plants unless there is a place for them. Your personal fancies should be left for more intimate sections of the grounds. Just grass and trees are more pleasing than a lot planted with no aim.

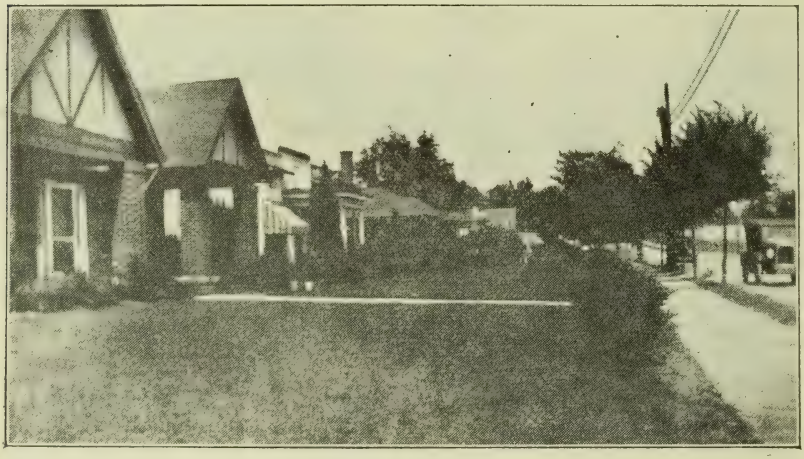
DO NOT "SPOT" PLANTS ALONG A WALL; GROUP PLANTING IS BEST.

Plants with soft, neutral textures are best. Try to get the fine textures (small sized leaves and compact growth)

where you will see them close by. Keep coarser materials as Pee Gee Hydrangea and Chaste tree at a distance. Showy material needs a background. A variety of foliage is bad. It is best to keep to the darker greens.

If the money which may be spent is limited, make the best of it by planting what you can buy at the important points and leaving the rest bare, or else, use the cheaper deciduous shrubbery in place of the more expensive evergreens.

Putting your design into practice requires care. The plants must be known. In order to secure desired effects, one must know how the plants will look at maturity. A poor selection is only a waste of money. It is not good policy to pick them out to secure an immediate effect .



A GOOD EXPANSE OF LAWN IN A SMALL HOUSE DEVELOPMENT.

OTHER PLANTINGS

Foreground—The foreground, framing, etc., equal in value and outline to foundation planting. It is not a part of foundation planting. A foreground must be provided to set the house off. This will be the lawn, and it should be nothing else but lawn. No fancy flower beds, scattering of shrubs or queer trees are wanted here to ruin a broad expanse. Keep the plantings to the foundations and to the boundaries.

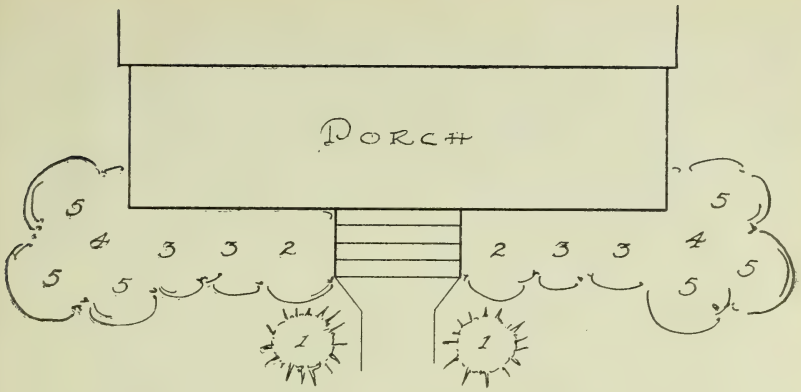


FIG. 4—A SIMPLE AND INEXPENSIVE PLANTING THAT IS EASILY MODIFIED

Framing—By "framing" is meant the foliage that acts as a "frame" for the house. Some sort of framing is advisable. On a small lot it must be done by using higher shrubs at the ends of the house; but where there is room, a tree at each end, diagonally about twenty feet or so from the house, is possible. Remember this before you cut down trees on the ground where you intend to build. It takes many years to gain the effect that may be secured immediately by established trees if allowed to remain.

Background—By background is meant the foliage behind the house that takes away the bareness of the sky. A background is very desirable. A house that can have a grove of native oaks or pine presents a much more homelike effect than a building with nothing but sky as a background.

THE FORMAL GARDEN

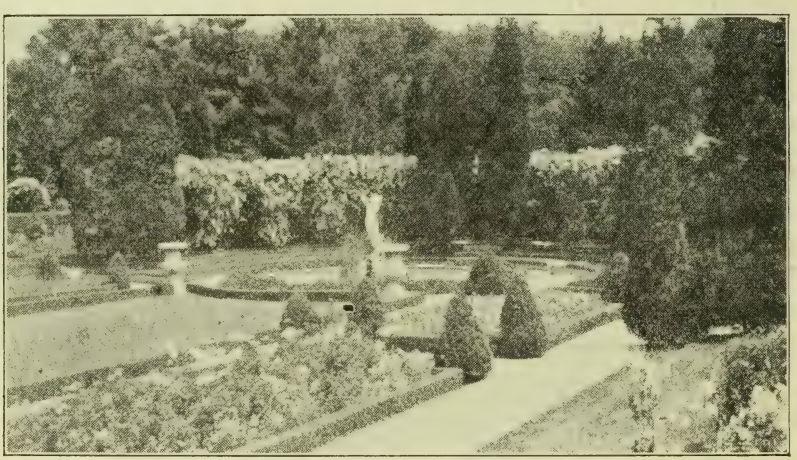
A garden is a man-made, bounded, out-door area, containing plants. Gardens must be relied upon in a large measure to furnish the home setting.

Formal gardens, which we shall consider first, have been greatly abused through a general misunderstanding in this country. We are lovers of the great outdoors,—of wild things,—freedom; we are partial to the informal

style. All this is very admirable and may such continue, but we must be open-minded and consider all things in their place. There is room for the formal as well as the informal style. The small, confined area immediately adjoining the residence is no place to attempt broad informal effects. Here the logical thing is to use a formal design.

Even in formal gardens man works hand in hand with nature. A tree in one corner, or flowering shrubs or evergreens will add a picturesque note to the composition. Formal gardens are really informal for when one is off axis,—everything is seen in an informal relation.

One should not be afraid to attempt something on the formal plan. There must be, of course, unity and balance, but this may be obtained without stereotyped arrangements. It is best not to copy, but plan a garden for your own home. There is safety in simple plans. The following suggestions on formal garden design will serve as a guide.



A LARGE FORMAL GARDEN.

1. Formal gardening should be attempted only on relatively small areas. For the ordinary place, one-fourth to one-half an acre in the garden area should be the maximum allowance; for a very pretentious private mansion, one to two acres. Best results are usually secured on areas considerably smaller than these maxima. There is danger in having too much space. Many of the most charming gar-

dens are very small. To reduce the size, irregular portions may be cut off for other use. A large space divided by many narrow walks and small flower beds produces the effect of several small gardens rather than one large one. The dimensions of parts should be ample, even in small gardens, for this gives style and character. The proper dimensions of parts must be kept. It is better to use fewer parts than to reduce large gardens.

2. The area should be rectangular or nearly so. Circular or semi-circular areas can sometimes be designed, but they are difficult. For rose gardens, the latter are the most pleasing arrangements.

3. The area should be level or nearly so. Where it slopes distinctly, it should be brought to two or more levels by terracing. This, of course, is expensive, but a change of level, even if of but a foot, will add much interest.

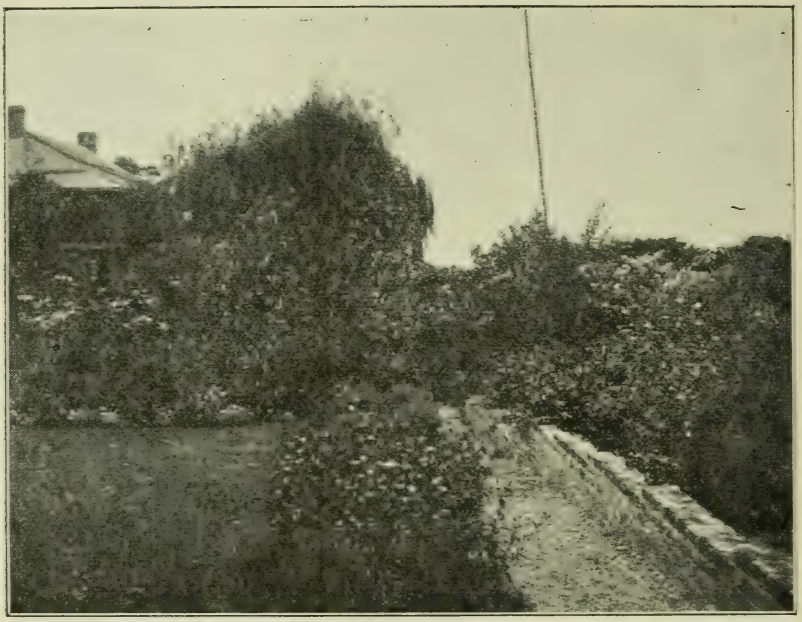
4. The formal garden should be wholly and distinctly enclosed, either by buildings, walks, hedges, or something which affords a definite boundary. Occasional outlooks may be provided through or over these bounds, but they must be managed with great skill. Enclosure is sadly lacking in many of our gardens. We do not wish to see all outdoors when we come into the garden; it is a visit in itself and should be enjoyed as such. If you have a particularly fine view, make the most of it, but put the garden elsewhere. The garden is best connected directly with the house, for it is but an outdoor living room.

5. In this rectangular space, no definite proportion between length and breadth is obligatory, but best results can usually be obtained with a ratio about 7:5 or 8:5. Come close to the ideal if you can. If you cannot, strive to make the best of it, which will mean a successful garden and the joy of accomplishment.

6. Each garden must have as its chief structural feature a major axis. This is the backbone and there should be nothing weak about it. This will nearly always be developed on the median longitudinal line. In exceptional cases, the main axis may be developed transversely to the greater length of the garden.

7. At right angles to this major axis, a minor axis should be developed subordinate to the major axis. In some cases

two or three minor axes are permissible. Sometimes the



IN THE BACKYARD GARDEN.

minor axis may be merely indicated or entirely suppressed.

8. The minor axis or axes must be distinctly subordinate to the major axis in all particulars,—width, length (usually,) in interest, and in termini (See 10, 11, and 12.)

9. Major and minor axes will often be treated as paths. These paths should be nicely proportioned to the size of the gardens. Ten per cent of the width of the garden has been given as the width of the path on the major axis, but consider this arbitrary, as it often happens that such is incongruous with good taste or personal fancy. The minor axis should be narrower. Paths, however, are not essential. If the axes are indicated definitely, the central area may be left in lawn. There is nothing more satisfactory than a small garden with an open lawn panel.

10. The termini must be objects of definite interest and beauty. Those features most commonly employed are fountains, bird baths, sundials, gazing globes, seats, arbors,

pergolas (of doubtful suitability, for a pergola should be a **connecting link,** not a unit within itself), statues, tea houses, and small buildings generally. A broad outlook over several miles of scenery does not terminate any axis, and it is never permissible to allow any axis to disappear into any exterior view.

11. These terminal features must be carefully proportioned in size and interest to the length and importance of the axes on which they are placed. Features on the major axis must be distinctly larger and more interesting than those on the minor axis. In case several minor axes are developed, their termini nevertheless definite, terminal features must be provided.

12. Fountains, arbors, belvederes, etc., must not be built within the garden so as to obstruct the general view. Under no circumstances should anything be built on any axis intermediately between the termini in such a manner as to interrupt the axis line. The intersections of axes may

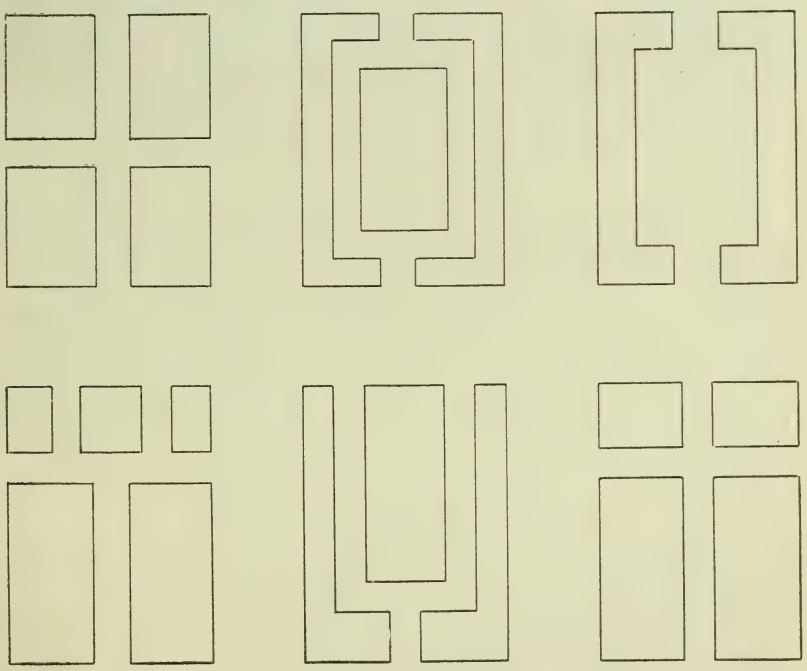


FIG. 5—FORMAL GARDEN DESIGNS

sometimes be marked by pools of flat water (not playing fountains). Pools in this position are attractive on account of the reflection they offer toward the principal points of view.

13. Whatever treatment is given to the free rectangular spaces outside the axes is better applied to the margins of such spaces than to the centers. The centers of such spaces should be left free, or at any rate, should not be made sites for mass effects of architecture or planting which would compete in interest with the axial termini.

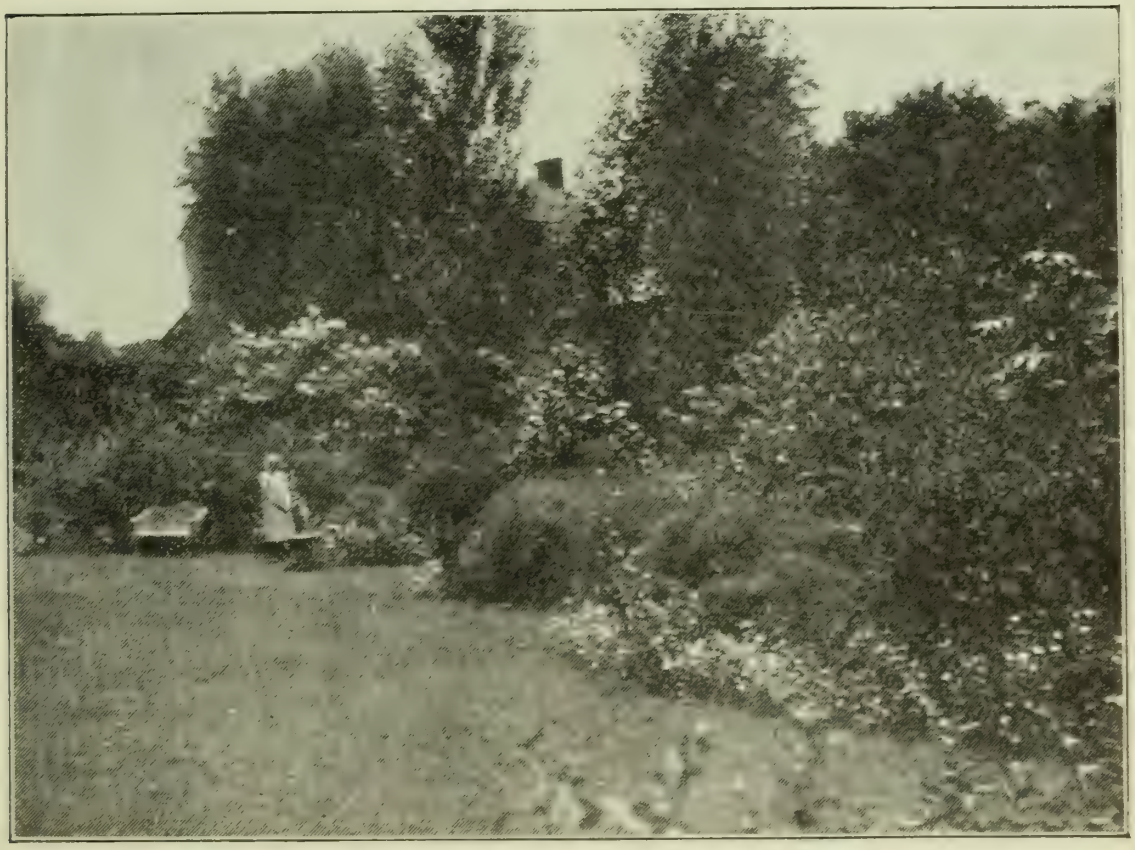
14. Color effects, where attempted, are better developed along the boundaries, in walls, hedges or border plants, than in the interior spaces. Filling up the centers is not good design. The beds, however, should not be placed next to hedges or tall plantings, as the roots of the plants will rob the smaller flowering plants of much needed moisture. A narrow strip of turf will give the necessary separation and make it easier to care for the beds. One-sided beds may be three to four feet wide, and two-sided beds six to eight feet in width. The width is limited by the practical necessity of ease of care. In all planting, one should try to have a sequence of bloom throughout the season. It must be remembered that good foliage is more valuable than bloom. It is preferable to have plants that are attractive at all times.

15. Details of architecture and sculpture must of course be kept **consistent** throughout the garden. All contribute greatly to the atmosphere of a place if well done. Simple and classical forms are usually to be preferred. Common sense is what must be used. A pergola may be so big and coarse as to overpower a garden, or a bird bath may be so small as to be lost among the roses. Keep elements in good scale. Nothing will serve except good taste refined by experience for there are no rules of real use.

THE INFORMAL GARDEN

A distant garden need not be so formal as one directly adjoining the living room. As we get away from man-made structures, we can make gardens nearer like those made by the hand of nature, and we can be freer to experiment with plants and different designs. An informal garden has de-

sign as well as a formal garden, but the form is not as obvious.

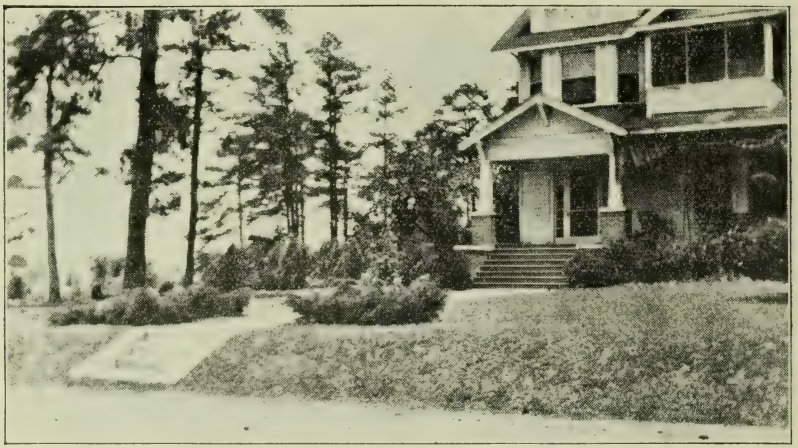


The screen gives privacy and forms a background for the flowering shrubs.

Every informal park or garden should be partially or wholly enclosed in order to give it a feeling of unity and sometimes of privacy, but this enclosure need not be so obvious nor so complete as in the formal garden. Good outlook should be especially preserved. The enclosure will be composed chiefly of borders of trees and shrubs. These can give a background for annuals and perennials, besides providing flower and color changes during the seasons.

The main structural features will usually be roads, paths, trails, or navigable waters, and the principal one of these lines will, as nearly as practicable, circumscribe the area under treatment. If you have a farmhouse set well back from the road, do not ruin the lawn and general design by cutting the drive through the center. Instead, use curves and keep the drive close to the boundaries. This likewise applies to plantings. Keep an open center to give the effect of unity and breadth. A winding path to outly-

ing features displays the yard from different views and this makes the place seem larger.



A GOOD NATURAL BACKGROUND OF TREES AIDED BY TASTEFUL PLANTING.

The principal considerations in locating drives, walks, etc., will be (a) The shape of the area (b) Topography (c) Convenience of travel between important points (d) Development of views. It is desirable to avoid the use of straight lines and radial curves, but awkward and unnatural curved or crooked lines must be equally avoided.

A succession of bloom is desirable whether you have a rock garden, wild garden, or water garden. Plant bulbs in clumps, not straight rows. These may be put in front of shrubbery groups or in groves of trees to bring the first color of the year before the leaves come out. There are times when the perennial beds are scarce of color. To prevent such, it is a good idea to plant annuals among the perennials to show their glory during the "in between times" of their hardy cousins. Evergreens add much interest during the winter months. Who is not enthralled by the sombre mystery of the pine woods? For the small garden, the looser, spreading types may be used. Save the stiff sorts for formal work.

The individual shapes of each shrub should not stand out, but they should be used in masses, and trimmed no more than is absolutely necessary. The best guide that can be used is the way that they grow in nature. One should

alternate the plants as much as possible, keeping away from the appearance of rows.

A POND PLANTED WITH NATIVE PLANTS.

A great deal of care should be exercised in the selection of plants for informal work to be sure of a natural effect. The native flowers, shrubs, and trees are to be preferred. Odd shapes, colors, or growths, especially foreign plants, should not be used. There is no need of being dogmatic on this point, however. If a plant introduced from another country looks native, it may be used as freely as the native ones. Effective results are what one desires.

ROSES AND ROSE GARDENS

The rose is unquestionably the "Queen of Flowers". Since time immemorial it has held an honored place in gardens, in literature, and in the heart of humanity. Today we admire it in all its forms, from the wild rose of our fields to the master-pieces of greenhouse culture. The homes of the South should have more roses. Here they are at their best and let us make the most of this good fortune.

Roses, in general, do not take well to informal gardening. In fact, they have been associated with formal gardens for ages. There is a practical reason for this. For best results, roses require prepared beds, careful cultivation, and a free circulation of air. Formal, massed plantings make the most effective showings. The same general

rules apply here as do in other formal garden work. Many pleasing radial rose gardens have been built in semi-circular, circular, or octagonal designs and it would be well worth your while to see if one of such designs is possible in your yard. A gazing globe, bird bath, or sundial is very appropriate as a center of interest. If there is a seat or a table with chairs, it will be a delightful place to linger.

The rose garden should be a complete unit within itself, for when the roses are in bloom the garden will be a marvel; when the limbs are bare and unsightly, it is out of the way. If one has but a few Hybrid tea or Hybrid perpetual roses, they may be put in a little bed by themselves. For enclosure, there is nothing that suits a small rose garden better than a trellis. The bush roses can be planted in the interior beds, while climbing roses can cover the trellis. If a simple rose arch, with or without a gate, is used as an entrance and covered with a climbing rose, it will be a beautiful point of division as well as an invitation to investigate beauties beyond.

It is advisable to keep rose beds narrow for this makes it easier to work about them and it is best for the growth, as the plants get more sun and a free circulation of air. Two to three feet in width is sufficient. Concerning planting distances, two to two and one-half feet and even one and one-half feet for smaller kinds is advisable. It gives a better appearance if you have the beds about six inches lower than the grass about them, but be sure that drainage is provided.

Rose beds should have some kind of a border. The bareness of the soil and lower branches can then be hidden. It likewise provides a background to a certain extent, and is generally neater and more in keeping with our old-fashioned Southern gardens. For this there is nothing more beautiful than Dwarf Box. However, this is expensive and Candytuft (Iberis sempervirens) or closely clipped Euonymus may be substituted.

It is essential that the ground be high, have plenty of air, and be away from trees that will cast shade on the garden and whose roots will rob the moisture intended for the plants. A good clay loam, well drained, is about the best soil. If it is inclined to be wet, dig out a depth of two feet, fill in the bottom for six inches with cinders or broken

stone and finish with rich soil.

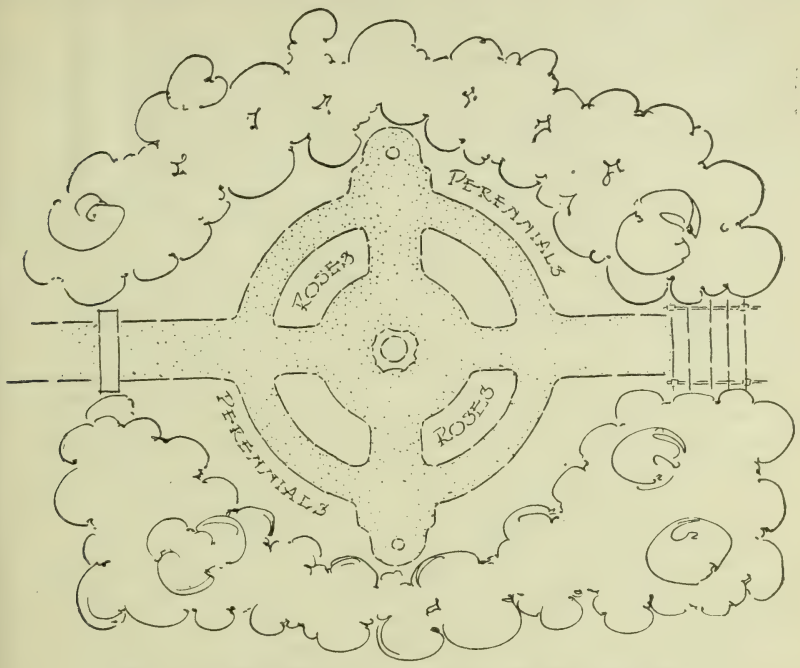


FIG 6—A SUGGESTION FOR A RADIAL FLOWER GARDEN

In many cases, wire fences about the yard have been made things of beauty by planting with climbing roses, all at little cost and care. Some of the more vigorous climbers make beautiful sights when trained up the trunks of trees, over rocks, and on dead stumps. With a little support, they will cover porches to provide protection from the summer sun.

Success with the rose requires the observance of certain points. When the roses are received from the nurseryman, one should be very careful to keep the roots from drying out before planting. If it has not already been done, one-third to one-half of the tops should be removed. Many well meaning people are shocked at the thought of making the plants smaller, but their fears are groundless, as this balances the top with the roots lost in transplanting and will produce better blooms the following season. For larger blooms and length of stem, the bush roses should be cut

back every spring to within six to twelve inches of the ground, removing all old hard wood and weak growths. If quality of bloom is desired, remove but one-half or one-third of wood. Climbing roses should be pruned but little in winter, but after they have finished blooming, the regular pruning should be given. Old, hard canes should be removed and the tips of the present year's growth trimmed slightly.

Do not be afraid to fertilize. There is nothing like rotted cow manure for roses. A layer spaded into the soil at the time of planting and mulch covering the ground every winter is advisable. The mulch can be spaded into the soil in the spring. Disease and insects can all be kept under control by proper spraying. A little attention will often be the difference between success or failure with roses.

The Mississippi Agricultural Experiment Station Bulletin entitled "Roses" by J. C. C. Price contains much valuable advice on the selection of varieties and general care of roses.

GARDEN ARCHITECTURE

Architectural details give charm and style to a garden. They should be simple and dignified, with a common style employed in all used. Simplicity should be the keynote and some one thing in the small garden should be featured. Do not try to "show off" with ornaments. They should never appear costly and only be used when they are apparently useful.

The bad taste of a past generation seems to be surviving when cast-iron dogs and deer are scattered around on the lawn. Someone got the idea of placing artificial tree stumps out in the middle of the lawn and filled them with petunias. If we must indulge in such, let us put them in an out-of-the-way corner of the back yard where they will not shock the taste of passersby.

The heavy and ornate garden ornaments seen on the Continent are out of place in the United States. We like to do away with unessentials. The simple, classic lines that do not strive for effects are the best.

The garden should be a place to be lived in. Seats or tables and chairs are really necessary to invite one to linger. To be livable, they should be comfortable and with ample dimensions, even in small gardens. They are best in a niche, sheltered from sun and wind. They may terminate

axes or provide rest where beautiful scenes are to be enjoyed. Finished wood, either painted white or with a dark finish, is the most practical. Stone is uncomfortable as is Rustic work. The latter should be used only in a naturalistic setting.

The home owners in this country are coming to realize that the plan for a porch is on the garden side where it can be livable, not on the front open to the stare of the public. It is the best connecting link between the home and the garden.

Tea or garden houses can be made a part of the design of the formal garden where their construction must be classic, or else they may be made rustic affairs in a woodland grove. They are always best when covered with plants.

The Pergola covered with blooming vines may be very delightful. One should remember not to have it a detached thing placed out in the yard. It should be the connecting link between areas.

Garden gates, with or without overhead arches, are among the main points of interest about the home. They may be merely rose arches covered with flowers. They may act as termini as well as make definite separations that aid the visitor to enter. Never have one of them placed by itself in an open area. There is no need for them to be expensive. Anyone with an ability with tools can make a presentable affair,—the simpler it is the better.

Architectural enclosures are necessary for privacy when there is no room for plants. Trellises are general favorites. They many be painted with green or a dark stain besides the conventional white and be less conspicuous. Fences, which are a necessity wherever cattle run loose, may be covered with planting and made a pleasing background for the garden. Walls should not be looked at with horror by Americans. They are the most effective means for privacy and can be made charming with vines and blooming plants.

Water adds interest and life to the garden. A common method of bringing it into the garden is by pools. These may be made of brick or concrete and water-proofed. In formal areas, the simpler designs are best. The coping should be low and very plain. The ridiculous practice of splattering a lot of stones around in a concrete coping

should never be done. In an informal situation the outline of the pool may be irregular and natural stone with the joints raked, may be used and the edges covered with overhanging plants. The reflections of bright colors is very pleasing. Water lilies are best grown in tubs in the pools. Goldfish, besides being interesting, will keep the pool free of mosquito larvae.

Water may be introduced into the simplest garden by a bird bath, whict will also attract bird life. They are very simple and attractive, are easily purchased, or they may be homemade. The bird bath may be a central feature in a radial garden, or it may terminate an axis.

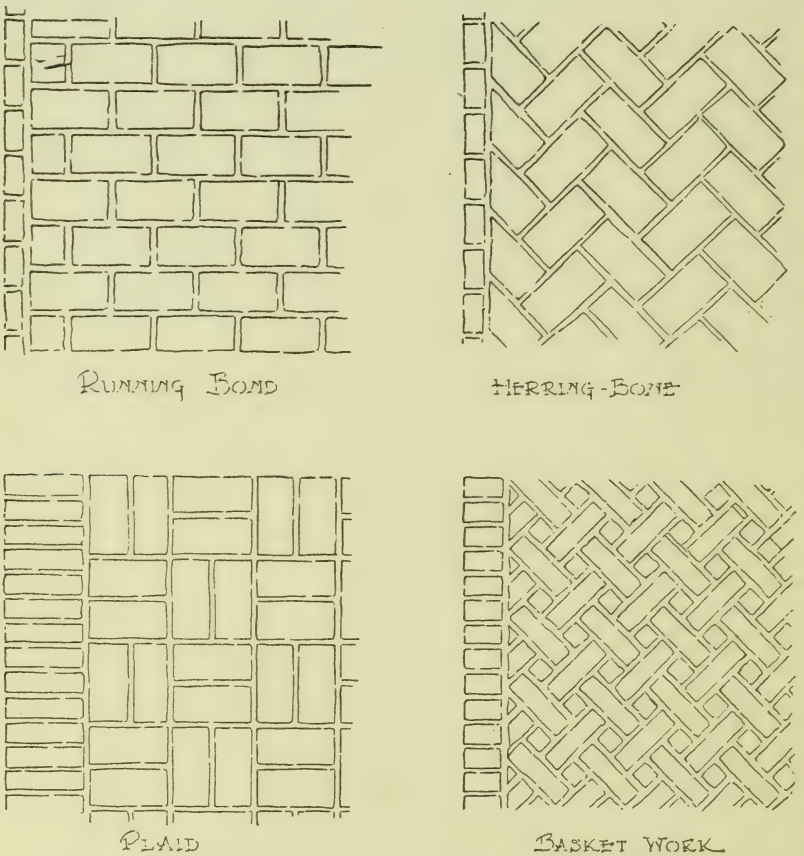


Fig. 7—**Brick Walk Designs**—Many modifications can be made of borders and centers. The Herring-bone and Basket work designs are best only for straight walks.

The sundial and the gazing globe have always been interesting. One should remember that there must be sunlight for the sundial and flowers should not be massed about it, as people like to go close to examine it. The gazing globe is a bit of curosity and should be used with restraint.

Simple little bits of sculpture can be very delightful if used with taste. Always keep the scale of the garden in mind.

Walks are everyday necessities, but they may likewise be made important parts of designs and very interesting in themselves.

The use of concrete seems to be a national mania. It has passed its limit when it tries to enter the home grounds. It is monotonous, glaring, and uninviting. Coloring matter in the finish layer will help.

Brick is far superior to concrete. When laid in concrete it is just as durable and may be arranged in many patterns, or it may consist of designs in a concrete walk. Many old brick walks in good condition are to be found that have been laid in sand, the softer tones being best.

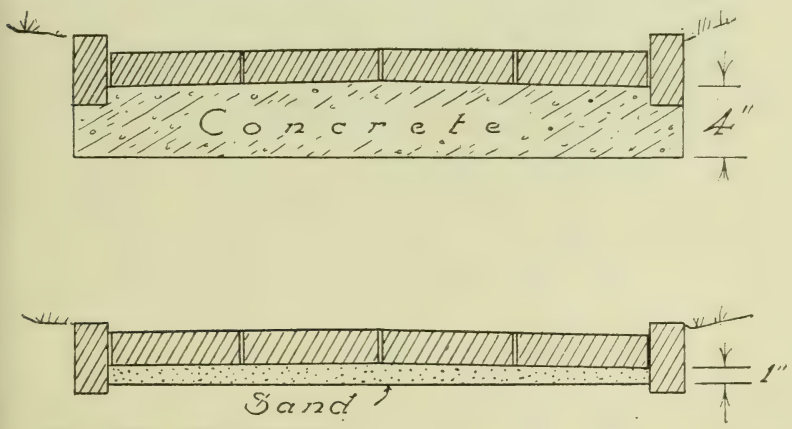


Fig. 8—Brick walk construction. Use 6 inches of well packed cinders beneath if drainage is poor. Remove all topsoil.

Gravel is very serviceable where the traffic is light and gradient not too great. The duller colors are the most pleasing. A walk that will stand a great deal of service and is very good-looking is one made of flagstones laid at random,

with grass growing between the stones.

For minor walks where flat stones are available, a very inconspicuous stepping stone walk is good. The stones should be flush with the surface of the ground so the lawn mower can pass over.

In a little garden and where there is very little traffic, grass walks are best. Even where other walks are used, there should be at least a twelve-inch strip of turf between them and the planting beds. The green turf sets the flowers off to best advantage.

LAWNS

When one thinks of a lawn in our climate, there is no question as to what type of grass shall be used. Bermuda is the standard, the much abused and little appreciated grass that exists in spite of all the ravages of man and weather. Bermuda, with its grayish-green color and spreading growth, does not present the very refined appearance that a lawn of Blue Grass does in the North, but when a hot, dry spell strikes northern lawns, havoc is very often wrought leaving great "burnt" areas in the lawns. On the other hand, Bermuda holds its own where others fail.

There should be more winter lawns. Surely there is no comparison between a fresh, green lawn and the dismal expanse of brown that is all too common in our towns during the winter months. With the little labor and expense of sowing Italian or English rye with white clover each year, one can have a beautiful green lawn until the Bermuda is ready to come up again. Lespedeza, if kept well clipped, will make a good summer lawn. Forty to sixty pounds of Italian or English rye to the acre, which is about one to one and one-half pounds to a ten-foot square, is sufficient. This is best applied in October, although successful results may be obtained all through the winter. This, of course, must be applied each season.

The commonest method of establishing a Bermuda lawn is by sprigging with roots dug from a well developed patch. The sod is dug up with a grub ax and the roots lifted with a fork and planted again as soon as possible to prevent any drying out of the roots. A good method is to put them into sacks. Before planting they are separated into small clumps and placed about twelve inches apart on

well prepared soil, then covered with about three inches of loose soil, and made firm with a roller or by tramping.

Naturally, if a good loamy soil is used as the basis for a Bermuda lawn, best results will be secured. However, if the grading about a new house has left areas of sub-soil a good stand of Bermuda is possible if a layer of manure one inch thick is worked into it before planting. The application of nitrate of soda at the rate of one hundred pounds to the acre at such a time and repeating in midsummer will produce a good sod in a year. Such applications of fertilizer are advisable every winter to keep the lawn in the best of shape.

Lawn grasses do not constitute the only method of covering ground areas with green. Indeed, there are many instances when other materials are far superior. There are many futile attempts made to get grass to grow in shaded places. Numerous homes surrounded with magnificient trees are impaired by having miserable patches of bare earth with scraggy turfs of grass here and there. The logical method is to use a ground cover that is adaptable for shade. In this class we have the Japanese Spurge (Pachysandra terminalis), Myrtle (Vinca minor) or Periwinkle, and English Ivy (Hedera helix). These plants, when placed one foot apart will soon make a permanent green carpet. An occasional weeding is all the attention they require. These may be used beneath individual trees with a regular lawn elsewhere if so desired. However, many an old home has been enhanced by solid covers of such plants.

PLANT MATERIALS

The term "plant materials" is applied to the various types of plants used in Landscape plantings. This includes trees, shrubs, vines, perennials, annuals, and bulbs.

DECIDUOUS SHRUBS

For a changing interest and variety throughout the year, the old-fashioned deciduous shrubs are the best. The wonderful flowering effects and autumn coloration is marred only by the fact that they are bare of leaves during the winter. Some varieties have more dense growth than others and make a better showing when the leaves are gone. Others will hold the foliage till well into the winter.

In selecting these, grace and character must be con-

sidered. One should usually raise the following points: Does the shrub "face down" well by its foliage coming down to the ground, or must a small shrub be put in front of it? Is the growth spreading or upright? Is it dense and refined enough to plant close at hand? Does it require sun or will it thrive in the shade? Does it prefer an acid or lime soil? What is the color, time, and character of its bloom?

Comments concerning a few of the more common deciduous shrubs is given below. The list is far from complete, but can act as a general guide:

The Butterfuly Bush (Buddlea magnifica) is really a summer lilac. Its lilac blue flowers from midsummer until frost are excellent for cutting. As the shrub has an open growth and often dies down during the winter, it is best faced with low growing shrubs.

The Japanese Flowering Quince, (Cydonia japonica) with its brilliant pink to scarlet blossoms is one of the first to welcome spring. The abundance of fruit in the fall is interesting. It has a spreading open growth three to five feet high. It will stand almost any soil and some shade. A few sprigs of the blooms in the house are beautiful. It can be trimmed into hedge form.

The Deutzias are old favorites. The slender deutzia, (Deutzia gracele) deserves more attention. For a dwarf edging plant, it is very fine, presenting a mass of white flowers in early spring. Of the tall sorts, Pride of Rochester, a double white tinged with pink in early summer, is the standard.

The Pearl Bush (Exochorda grandiflora), makes a dense, spreading top eight to ten feet high when given moist soil and a sunny location. It has white flowers in early spring and is a very good shrub.

Golden Bells, or Forsythias, give us masses of gold in early spring that are especially good if there is an evergreen background. Weeping Forsythia, or Forsythia suspensa, is spreading and useful for covering banks. The Fortune Forsythia (Forsythia fortunei) is about the best variety. It has an upright growth reaching eight to ten feet. The Green-stem Forsythia (Forsythia veridissima) has attractive green stems.

The Shrub-Althea, (Hibiscus syricus) is an old garden favorite, flowering from early summer until frost with col-

ors from pure white to dark purple. With its tall upright growth it is best kept as a high plant to the rear of shrub plantings.

The large panicles of Peegee hydrangea (Hydrangea paniculata grandiflora) are common sights in midsummer. They should not be planted close to doorways or out on lawns, but should be kept in mixed shrub borders as the growth and flowers are coarse. The Oakleaf hydrangea, (Hydrangea quercifolia) is a small shrub and desirable, except that it is very bare-looking in the winter. When a low growth is needed, the dwarf-growing Goldflower, (Hypericum moserianum) will produce waxy yellow flowers all summer and will stand partial shade.

An interesting winter effect is secured by the familiar Winter Jasmine, (Jasminum nudiflorum) with its graceful green branches and yellow flowers in January. It forms a low, dense growth and will stand shearing. The Primrose Jasmine is another small rambling type.

The shrub that should be on every southern grounds is the Crepe Myrtle. A double row of these in bloom in late summer with their tall, upright growth is a magnificient sight. They should have well drained soil and full sun. Keep away from the purple shades in your color selections.

One of our best shrubs is the Winter Honeysuckle (Lonicera fragrantissima) that makes a round-headed shrub six to eight feet tall and is well faced to the ground. The small, but very fragrant white blossoms are very welcome in late winter. The Morrow and Tatarian honeysuckle are good for all round medium growth.

The Sweet Mock Orange or Syringa (Philadelphus coranarins) is worth while in the mixed border. It is a handsome shrub eight to ten feet high with white flowers in the spring. The Virginal type, (Philadelphus virginalis), is very fine with its large double fragrant flower.

The Pomegranate (Punica granatum), with its erect, nearly evergreen growth and flowers from white to red in summer is desirable in the mixed border. Its branches reach from six to ten feet.

The Anthony Waterer Spirea is a valuable dwarf shrub. The flowers are magenta, coming in midsummer on dense upright growths. Spirea Thunbergi is most valuable for low plantings or facing down other shrubs. The white

flowers come in early spring on dense, graceful branches. It will hold its foliage during Autumn after turning orange and scarlet.

The Van Houttei spirea grows to six or eight feet, but its arching branches touch the ground and its white clusters are striking in March. The Reeves Spirea, (Spirea reevesiana) is similar but flowers about two weeks earlier, a fact to remember when working out a succession of blooms. Spiraea prunifolia, or the old-fashioned Bridal Wreath, is always good.

The Coralberry, (Symphronicarpos vulgaris) is often despised for its commonness, not because of its qualities. It is covered with coral red berries all winter and is especially good for planting banks or in naturalistic work.

Where the old-fashioned lilac will grow without mildewing badly, it is most satisfactory. It should be allowed to form a bushy clump by letting shoots come up unmolsted.

The common Snowball, (Viburnum opulus sterile) is free growing with white balls in early spring and is generally popular. Its cousin, the Japanese Snowball, (Viburnum tomentosum plicatum) is rather better because it does not become infested with aphids.

The Chaste Tree or Lavender Bush, (Vitex angus-castus) with its blue, pink or white stalks borne on open, rank, spreading growth, is best used by large building or in naturalistic planting, not by the small, refined home.

Of the Weigelias, there is Eva Rathke, a good red blooming sort in summer with a spreading growth reaching eight feet. Weigelia rosea is a good deep pink. It is best used in mixed borders.

The Firethorn (Pyracantha coccinea lilandi) has a picturesque growth of ten to twelve feet. The white flowers in the spring produce orange berries that stay on all winter. This is best in mass plantings.

BROAD-LEAVED EVERGREENS

For all year round informal and formal work, the broad leaved evergreens should be in every planting. They take less time and trouble to get pleasing results than with the other evergreens. Many will stand shearing, making them available for hedges and for use in plans where they would naturally grow too tall. The South is particularly

fortunate in having a large variety of these desirable plants. The list of broad leaved evergreens contains merely a few suggestions from the extensive collection grown in the South.

The best all-round shrub we have is the Abelia. Its white flowers from May until frost are pleasing and it holds its leaves through winter. It will grow to five feet but can be kept lower by pinching back the vigorous growth. This is always advisable to form well-shaped specimens. It will stand a good deal of shade, being particularly valuable for plantings on the north sides of houses.

The boxwoods are unsurpassed for charm. The Dwarf Box, which is intimately associated with things southern, is recommended for any formal planting. The Tree Box is faster growing and forms a cone-shaped head. Either is worth while to edge flower beds or walks.

A plant that will endure quite a bit of shade is the Evergreen Burning bush, (Euonymus japonicus). It will grow to seven feet, but can be trimmed to any size or shape, making a good hedge. The Spreading Euonymus, (Euonymus patens) is semi-evergreen, but worthy of attention because of its symmetrical growth and orange berries in winter. The Winter-green Euonymus radicans, is good for covering banks and as a ground cover where grass will not grow.

Our beloved Cape Jasmine, (Gardenia florida) is famous for its very fragrant, waxy flowers. Where it will stand the winter, it makes a beautiful round shrub of medium height with rich green foliage.

Given full sun and good drainage the Carolina Cherry-Laurel with its rich, glossy leaves and good shape, makes one of our best tall shrubs. It is of quick growth, making an effective screen. The English Cherry-Laurel has large magnolia-like leaves and a spreading growth. It is of slower growth and generally does not grow higher than eight feet.

For diversity of use, we have the privets, Ligustrum lucidum. The Glossy privet, with its rich, shiny leaves and spreading growth, is excellent for foundation planting. The Nepal privet, Ligustrum nepalense, is similar. The Japanese privet has long leaves and an upright growth of ten feet. It will stand trimming and most any situation. For

all round screen planting, for clipped hedges and formal shapes to take the place of Box, one can use the Amoor River. They will all stand partial shade.

Given well drained soil and partial shade, the Leatherleaf Holly Grape, Mahonia bealie (often misnamed Mohania japonica) will do well and make a broad plant five feet tall. The yellow flower spikes in January and February are interesting against the dark holly-like foliage.

The Nandina reminds one of the sub-tropics with its bamboo-like foliage. Given care in fertile, well-drained soil, it will make a bushy plant four to five feet high. In winter the scarlet clusters of berries and beautiful bronze foliage make it very attractive. It will stand partial shade.

CONIFEROUS EVERGREENS

Conifers are desirable for an all year round effect and a variety of shapes and outlines. They will stand out as definite accents against the house. A too extensive use of them means lack of charm and undue monotony. Many accents are the most monotonous of all. It is often wise to use them only on corners, entrances, etc., and to use broad-leaved evergreens or deciduous material as fillers.

It is safest to keep to the neutral greens when selecting plants. You will tire of having a pair of bright golden arborvitaes at your door. Make sure that the plants are hardy in your section by seeing how they grow in your region.

Evergreens need a deal of care. Some are dwarf and will never get out of bounds, while others need to be kept within bounds. They should be trimmed back or transplanted when they become crowded. Replace when necessary for the absence of a single plant will often times ruin a design. The plantings will then last a number of years. There is an endless number of sizes and forms, but a few suggestions as to their general uses are in order.

For formal, balanced effects at entrances, we have the compact, dwarf-growing Greek Juniper, Resedale Cedar and the Globe Arborvitae.

For fronting other evergreens and for low plantings beneath windows and low porches, the Pitzer Juniper is unsurpassed. There are likewise a number of prostrate, trailing, and creeping Junipers that will serve the same

purposes. It is more difficult to cultivate about the latter. They are excellent for covering the slopes on terraces.

For columnar, accent types, there are quite a number. The Arizona Cypress holds a beautiful color all winter, but is rather erratic in growth. Its relative, the Italian Cypress, is unsurpassed for stately formal effects. Be careful as to how far north you plant it, as it is liable to winterkill. The Chinese Juniper and its varieties will give a pleasing variety and good form with the silvery green foliage.

The Arbor vitaes tend to turn brownish in winter except for some of its varieties. Such types as the Green and Texas Glauca and other varieties are good.

TREES

Trees are important adjuncts of the home in the warmer sections where shade is a health consideration. Small trees may be used in larger foundation plantings or in shrubbery borders. Their use in framing the house has already been discussed. For street use, the higher branching sorts and those that will stand hard conditions are to be preferred. One should keep away from the showy trees at all times.

The Cedrus deodara is a beautiful and graceful tree, but one should remember that it grows to 75 feet in height and needs room. It has no place in the planting against the house or on the small shaded lawn. Remember not to ruin the expanse of your lawn by placing it in the middle of it; if used, it should be kept to the corners. Do not attempt to use the Blue Spruce in the South.

The Southern Magnolia, (Magnolia grandiflora) is a magnificient tree with its large, glossy foliage and fragrant flowers in the summer. The bottom branches should not be trimmed up, as a magnolia with its branches touching the ground is the most beautiful, and there will not be the unsightliness of dead leaves which drop continually.

Among the small trees, the Redbud, Dogwoods, and Carolina Buckthorn can be used in informal shrubbery masses. The Umbrella Catalpa, (Catalpa bungei,) can be used only in the most formal planting. Do not ruin your front yard by putting one on each side of the path. That is an atrocious habit that is prevalent in some sections of this country.

The Texas Umbrella Tree has also been the bane of many a front yard, for its odd shape makes it out of harmony with all else. The Mimosa is another offender. They are best in the back yard for supplying shade for a table and chairs.

Of shade trees, there are quite a number. The Maples are mostly all good. The Silver Maple should be used for quick effect, but its branches break easily. The American Sycamore makes a good street tree where it thrives. One should find out about it in his region before buying. The oaks are at their best in the South both for lawn and street planting. For Autumn coloring, the Black Gum is highly desirable, as is the Sweet Gum. Both are fine all round trees. The Hackberry is very valuable, especially for hard street conditions. The fast growing Lombardy Poplar will make a high screen quickly. Its spire-like growth makes an accent in the sky line. It is, however, a short lived tree.

VINES

See also "Ground Covers" under "Lawns"

In many cases, vines constitute the major portion of the foundation planting. They may be used on old stumps, fences, arches, and for general screen purposes. Some, such as the Southern smilax, Clematis, Honeysuckle, Wisteria, and Roses, require support of some kind. Lattice work is the best, but wires, even chicken wire will serve the purpose. The kinds that require no support are Boston Ivy, Virginia Creeper, and English Ivy. The latter is slower growing, but is to be preferred to the other two because it holds its leaves and will stand shade. They should not be allowed to climo over the woodwork, as they will rot the wood and cause trouble when the house must be painted. They are best appearing on brick or stucco.

OTHER PLANTS

Perennials can often be made part of the general plantings, either by themselves or facing shrubs. The better foliage sorts, such as Iris and Peonies, are to be preferred. In the garden, they provide bloom year after year with little attention. Annuals are sometimes useful to help out for a year or two while the shrubs are getting established. They are valuable for filling in bare areas in the perennial beds.

Early in the spring, the sight of Crocuses and Jonquils blooming among the shrubs is very beautiful. Lilies like the protection of deciduous shrubs and will pay well for their care. Clumps of tulips will be riots of color and show off well with shrubs in the background. In all planting of bulbs, never plant in definite rows, but always in informal, naturalistic groupings.

Anything in the way of flower display must be done with restraint. It is not good taste to display everything you have to the world. The place for intimate gardening is in the private portion of the home grounds.

SHRUBS ARRANGED ACCORDING TO HEIGHTS

The following lists are merely approximate guides for arranging shrubs according to their heights. Those in the first group may be planted two to three feet apart; those in the second, three to four feet, while those in the third group may be spaced four to five feet. You may "plant thick and thin quick," but be sure to remember to remove the extra shrubs to give the remainder space to develop.

2-4 feet.	Deutzia lemoinei—Lemoine D.
	Mahonia japonica—
	Deutzia gracilis—Slender D.
	Hypericum moserianum—Goldflower
	Jasminum nudiflorum—Winter Jasmine
	Jasminum primulinum—Primrose J.
	Spiraea Anthony Waterer—A. W. Spirea
	Spiraea Thunbergi—Thunberg Spirea
4-6 feet.	Deutzia scabra—Fuzzy Deutzia
	Spiraea prunifolia—Bridal Wreath
	Hydrangea paniculata grandiflora—Peegee H.
	Spiraea reevesiana
	Symphoricarpos vulgaris—Coralberry
	Abelia grandiflora—Abelia
	Gardenia florida—Cape Jasmine
	Nandina demestica—Heavenly Bamboo
	Buddlea magnifica—Butterfly Bush
	Cydonia japonica—Flowering Quince
	Forsythia suspensa—Weeping Forsythia
6-10 feet.	Exochorda grandiflora—Pearl Bush
	Philadelphus coronarius—Sweet Mock Orange or Syringa
	Syringa persica and var.—Persian Lilac
	Laurocerasus caroliniana—Caroline Cherry Laurel
	Laurocerasus officinalis—English Cherry Laurel
	Ligustrum japonicum—Japanese privet
	Ligustrum lucidum—Glossy privet
	Pryacantha coccinea lalandi—Firethorn

Deutzia, Pride of Rochester
Forsythia intermedia
Forsythia suspensa fortunei
Forsythia Viridissima
Hibiscus syriacus—Althea or Rose of Sharon
Lonicera fragrantissima—Winter Honeysuckle
Punica granatium—Flowering Pomegranate
Spiraea Van Houttei
Tamarix gallica
Vitex agnus castus
Weigelia—in variety

CARE OF SHRUBS

A word concerning thinning and pruning in general is in order here. Among the fine old people of our country, there is a tendency to revere the old order of things and to hesitate to disturb existing things. However, when a planting becomes overcrowded, transplanting or the ax must be considered. An adequate number of plants should be planted to give a good effect from the beginning, but as the superior specimens show themselves, the thing to do is to remove the less adaptable plants to make room for their betters. A general jumbled mass is displeasing to the eye. Many plants become "leggy" and often show bareness at the base. With our fertile soil and many days of sunshine, shrubs make wondrous growth unheard of in less favored climes.

Spare the pruning shears as long as possible, but when the time comes for needed changes, make out a definite plan of what is to remain and what must be sacrificed, and then be bold and uninfluenced by petty ideas that may arise. Take out all interlocking branches, dead or diseased branches. Any shaping up is best done by taking out branches throughout the plant. Do not shear. Sun is needed throughout the plant in order to produce bushiness and bloom. A thinning out of the old branches is occasionally desirable. It is with some of the young shoots where they are crowded. Do not break off branches, as it will leave stubs which are excellent starting places for fungi.

The same principles apply to trees. A little judicious pruning once in a while will insure a long life for a tree. When cutting off branches, cut close to the main trunk in order that the exposed place may callous over; otherwise, the stub will cause decay that will go down into the main trunk.

If there are any rotted areas, the desired parts should be cleaned out and the cavity painted with creosote. Do not slash and mutilate trees and expect them to live. If they do live, they will advertise the fact that their owner committed atrocity.

With evergreens in the foundation planting, it is often necessary to practice some method to keep them within bounds. If the plants are trimmed lightly in the early summer after the first vigorous growth, they will make better shapes and keep within bounds for a long time.

The Time to Prune

A. Plants which should be pruned while the plants are dormant are listed below. These blossom on the present year's growth during summer and autumn:

Weigelia
Hibiscus (Althea)
Hydrangea
Hypericum (Globe Flower)
Ligustrum (Privets)
Philadelphus (Sweet Mock Orange)
Lagerstromia (Crepe Myrtle)
Punica (Pomegranate)
Tamarix
Vitex (Chaste Tree)

B. The following plants blossom early in the Spring on the previous year's growths. They are to be pruned following the flowers:

Exochorda (Pearl Bush)
Forsythia (Golden Bell)
Most Spireas
Syringa (Lilacs)
Viburnum (Snowballs)
Cydonia (Flowering Quince)
Jasminum
Lonicera (Honeysuckle)
Pyracantha (Firethorn)

Fertilization

The best fertilizer that can be given shrubs is well rotted manure applied during the winter. The winter rains will wash the plant foods down where they will be available when growth starts, and the organic matter can remain on as a protective mulch for the roots. Never use fresh or "green" manure, as it will "burn" the plants. See the material on "Lawns" for fertilization of grass.

HEDGES

Hedges are important features in the home grounds development. They provide privacy without offense in the private garden. They act as screens to hide unsightly objects and are used for formal effects about the house and in the formal garden.

Evergreens—The evergreens are especially valuable

as they give an all year green wall. The privets are the most commonly used. They will all stand close shearing, but the Amoor River is the one universally used. It can be kept trimmed to one foot or will make a loose screen 20 feet high. The Evergreen Burningbush, with its rich green leaves, makes a very attractive hedge where it is not affected by scale. Both the Dwarf and Tree Box make charming hedges. Even if they are left untrimmed, they will have a picturesque formality. They are very good for edging flower beds. The Arborvitaes will quickly make an all round hedge. They can be planted for high screens, as they are most commonly seen, or can make a beautiful clipped hedge. The browning of the foliage in winter is of some objection. What will make a beautiful hedge, though not commonly seen as such, is the Cedrus deodara. Its first cost is considerable, but it is worth it for a really fine effect. The English and Carolina Cherry Laurels will make effective informal screens to cover unsightly objects or to secure privacy.

Deciduous—Among the deciduous shrubs, the Citrus trifoliata, or Hardy Orange, with its thorns, will make man or beast go the other way. The spectacular Flowering Japanese Quince, Cydonia Japonica, will stand shearing and, if well cared for, make a dense hedge four feet high. The Hawthorns and Firethorns have long been used as hedges and are well worth considering. Roses, allowed to grow freely, will make a low, informal hedge. They cannot stand much clipping. Spirea thunbergi, if left untouched, makes an interesting low hedge. Its dense growth makes it useful, even in winter.

General Considerations

Close planting and early and regular pruning are necessary to prevent hedges from getting ragged at the base. Another preventative of poor bases is to have the tops narrower than the bases. A cone-shaped form is good.

The privets are best planted alternately in double rows about 18 inches apart, though greater distances are possible. At the end of the first year's growth, shear the plants down to within 8 inches of the ground. The plants will then send up more shoots and make a stronger base. Let the hedge gain height slowly; what is lost in effect at first

will be repaid by a substantial, long-lived hedge. Evergreen Burningbush had best receive the same treatment, as should the deciduous shrubs that can be closely clipped.

If a trimmed Arborvitae hedge is desired, it is wise to start early to shape up the plants for the ultimate size desired. One cannot cut back into the old wood of the conifers. Instead, one must trim only on the new growth. It is for that reason that early summer, after the first vigorous growth, is the time to do most of the trimming of evergreens. They can be planted 2 to 3 feet apart.

The Cedrus Deodara should very early have its top pinched out and any new leaders must be kept back. As with the Arborvitae, trim back the side growths in the early summer. Always work slowly with these types of plants; it is consistent care that will produce hedges of perfection.

Hedge plants crowded together are heavy feeders. Before planting, it is advisable to dig a trench and put well rotted manure at the bottom and then a layer of good soil before the plants are placed. Some rotted manure during the winter to be spaded in at spring, or two or three light applications of commercial fertilizer during the season, will produce a healthier hedge.

Acknowledgments

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Cuts 1-8 inclusive and No. 12 were taken from the personal collection of Professor Ware and used by his permission.

BULLETIN 268 JUNE 1929

BEEF CATTLE PRODUCTION IN MISSISSIPPI

BY
GEO. S. TEMPLETON

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
J. R. Ricks, Director

SUMMARY

A progress report made on the basis of two years experimental records indicates that shelter is not necessary in this climate for mature cows, yearlings, or weanling calves if the cattle are in good condition when they go into winter quarters and they are properly fed during the winter.

The average grazing period for the past five years, 1924 to 1928, inclusive, extended from the twenty-sixth of March to the eighteenth of December, or 268 days.

Good grade beef calves, dropped on pasture during March and April and having no other feed than good pasture and their mothers' milk, weighed for an average of five years 416 pounds when weaned in December.

Yearling steers and heifers with an initial weight of 480 pounds on pasture made an average gain of 186 pounds per head for the grazing season.

The wintering period for the six year average, 1924 to 1929, inclusive, extended from the nineteenth of December to the twenty-fifth of March, or 97 days.

A ration of 1 pound of cottonseed meal, 15 pounds sorghum silage, and 5 pounds No. 1 Johnson grass hay per calf per day satisfactorily wintered weanling calves with an initial weght of 416 pounds.

With cottonseed meal at $40.00 per ton, sorghum silage at $2.80 per ton, and No. 1 Johnson grass hay at $12.00 per ton, the wintering feed cost per calf was $6.67 per head.

A ration of 1½ pounds cottonseed meal, 25 pounds sorghum silage, and 8 pounds low grade Johnson grass hay satisfactorily wintered yearling steers and heifers with an initial weight of 613 pounds.

With cottonseed meal at $40.00 per ton, sorghum silage at $2.80 per ton, and low grade Johnson grass hay at $6.00 per ton, the wintering feed cost per head was $8.93.

A ration of 1 pound cottonseed meal, 30 pounds sorghum silage, and 5 to 7 pounds low grade Johnson grass hay per head per day satisfactorily wintered mature beef cows and two year old heifers with an initial weight of 1038 pounds.

With cottonseed meal at $40.00 per ton, sorghum silage at $2.80 per ton, and low grade Johnson grass hay at $6.00 per ton, the wintering feed cost per cow was $7.53.

Three groups of heifers of the 1924-25-26 calf crops have been developed as outlined in the bulletin for managing the herd during the grazing and wintering periods. These heifers, as three year olds, have had plenty of substance, have been well developed, have averaged a thousand pounds in live weight, have produced well developed calves, and have made satisfactory brood cows.

Beef Cattle Production in Mississippi

By

GEO. S. TEMPLETON*

The beef cow has always been a source of considerable income for the farmers in many sections of Mississippi. The topography and natural fertility of the soils of the state, a sufficient and well distributed rainfall through a long growing season, available and cheap lands, and a congenial climate are the factors that favor a beef cattle industry in this state.

Even with these very favorable natural advantages, we find in the agricultural yearbook for 1928 that the total cattle population of the state for 1929 (preliminary report) was 835,000, a decrease of approximately 10 per cent for a five year period. No doubt the largest contributing factors for the decrease were the low prices that prevailed for this commodity during a part of this period and the favorable price for cotton.

The human population of the United States is increasing at the rate of about 1,500,000 people annually. For the past 10 year period, the average per capita beef consumption in the Union has been 68.2 pounds. If the future supply of beef for the American table is to be kept up to the ~~beef~~ beef standard and be furnished from home supplies, it would require an increase annually of 186,000 head of 1000 pound steers. About the only territory that is left for expansion of the beef cattle industry is the Southeastern States.

CYCLES OF PROSPERITY AND DEPRESSION IN BEEF CATTLE PRODUCTION

The purchasing power of beef cattle tends to follow a rather definite cycle. The low points in the curves for production coincide quite closely with the high points in the curves for prices. The average length of time from high point to high point in prices is about 14 to 16 years. According to the yearbook of agriculture, the industry is now near the low point on the production cycle and the high point on the price cycle. Apparently, the world beef supply is somewhat similar to that in the United States; consequently, the outlook for the cattle industry in this country is very favorable for those who are established in the business. The low point in the price cycle offers greatest opportunities for starting in the business.

NEEDS FOR MORE EFFICIENT METHODS OF BEEF CATTLE PRODUCTION

A close study of the cycles for prosperity and depression should give the beef cattle producer valuable information for increasing or decreasing slightly his volume of production, but the cattle business itself requires a careful planning of the farming operations and equipping the farm so that about so many cattle can be taken care of properly year in and year out. Attempts to start in the business and stop production on the basis of changing values have proved disastrous. The most successful men in the

*The author is indebted to Mr. D. Maxwell who superintended the feeding of all the cattle used in these tests.

industry are the individuals who have planned their operations over a long period of years, have studied carefully the market requirements, have improved their pastures, have produced very largely all the feeds they have used, have enhanced the value of their herds by using carefully selected herd bulls, have produced a product that the market demands, and have had the product ready for the purchaser at the season when there is the greatest demand.

The beginner should familiarize himself carefully with the phase of the beef cattle industry that he wishes to develop and make a complete study before he launches into the business. There will necessarily be numerous problems that will have to be solved as the business grows.

It is the purpose of this bulletin to outline as simply as possible the answers to a great many problems that come up in producing market beef cattle in this section. The recommendations are based very largely on the studies that have been made with the breeding and management of the beef herd on the Mississippi Experiment Station for the past six years. A list of helpful references is included in the back of this bulletin.

Care and Management of the Herd

BEFORE PURCHASING THE CATTLE

The first thing that the prospective cowman should learn is that he must provide the necessary equipment and arrange for his pastures and feed before any of the cattle are purchased. The prospective breeder should read up on the references cited and it would be time well spent for him to visit as many cattle producers as possible, talk to them about their methods of production, and study carefully the contributing factors to their failures, as well as their successes.

EQUIPMENT NEEDED

Fences. The cowman cannot control his own land and certainly he cannot expect to improve his herd by the use of good herd bulls, or improve his pastures, or utilize his land to the best advantage until the farm is properly fenced. Expensive fences are not an asset to economical cattle production but well built, durable fences are essential and one of the most important parts of the beef cattle equipment on the farm.

Pastures. Good pastures furnish the cheapest feed that can be used in producing beef cattle for the market and these areas of the farm will have to be made the backbone of the production. Pastures will not only furnish the necessary feed for the herd during the great portion of the year, but the pasture is the healthiest place for the herd.

Improving Pastures. The native grasses of the South, the bunch varieties and the wire grasses, furnish satisfactory grazing for only a short season. Fortunately for this section, there is a large variety of carbonaceous and leguminous pasture plants that can be selected for any given soil type or condition that will give a well balanced grazing for the full growing season. It is possible in most cases by carefully studying the pasture requirements of a farm and by developing a simple pasture improvement program to increase the carrying capacity of a permanent pasture one to two hundred per cent in three to four years time.

The seven essential points for building pastures in Mississippi are as follows:

1. Cut all underbrush, briars, and weeds and put the pasture area in condition for regular mowing.

2. Select a mixture of pasture plants that are adapted to the given area and use as many varieties of carbonaceous and leguminous plants in the mixture as possible to give a full season of good quality grazing.

3. Stop the burning over of the pasture area, for the desirable pasture plants cannot reseed and multiply under this practice. Burning favors the production of undesirable pasture plants.

4. Stop the washing of the soil by the proper utilization of terraces where necessary, and the sodding of surfaces where the erosion is less severe.

5. Prevent over-grazing. For the maximum production of forage in the pasture, it is necessary that the plant make considerable growth and reseeding and improving the pasture is impossible where too many animals are maintained on the area.

6. Pasture plants require plant food for development. Generally speaking, the farmer knows the plant food deficiencies of his soil and the amount of fertilizer that must be added for the economical production of cultivated crops. Usually the same principles can be applied to increasing the fertility of his pasture areas as are practiced on his cultivated fields.

7. Conveniently placed shade trees are essential to the comfort of the animals. By selecting the proper varieties of trees, a money return can be secured from the trees in addition to the protection they will give the animals in the pasture.

Water Supply. The beef herd should have free access to a pure supply of water at all times. Deep wells, springs, streams that are not contaminated, and pools or ponds can be used as sources of supply. It is very essential that the supply of water be well guarded, for some of the cattle diseases are harbored in poorly drained, muddy, filthy places. The water supply should be dependable and sufficient to last throughout the pasture or wintering period.

In the construction of pools or ponds, the excavation should be deep and narrow to reduce as much as possible the evaporation during the warm season and to keep the water cool and palatable. The planting of desirable shade trees on the west banks of the ponds will aid materially in keeping the water cool.

Shelter. Expensive shelters for the beef herd are unnecessary in Mississippi. The climate throughout the year does not subject the cattle to critical temperatures. Probably they suffer most during the wet, windy periods of the winter. Thin cattle suffer more during these short periods of time than do cattle that are carrying the proper amount of flesh. Cowmen differ widely in their recommendations as to just how much shelter is necessary on the farm. Some claim that a cheap shelter is economical for mature cattle because of the amount of feed saved by the protection that is given and they are quite sure that shelter for the calves is essential. Others favor wintering the mature cattle in the open, but provide shelter for the calves and young cattle.

For the past two years, an experiment has been under way to determine

what effect and what economic saving there might be in providing shelter for wintering cattle of the various ages. For the first winter's test, two lots of mature cows and two year old heifers and two lots of weanling calves were selected for the test. The comparable lots were divided equally as to breeding, age, and quality. The rations were the same and the only variable that was introduced was the question of shelter or no shelter.

Table 1 gives the results of the first wintering period as follows:

Table 1—The Effect and the Economic Value of Shelter for Wintering Beef Cattle.
December 16, 1927 to March 27, 1928 (101 Days)

	Lot I Shelter	Lot II No Shelter	Lot III Shelter	Lot IV No Shelter
Ration	1 lb. C. S. M. 30 lbs. Sorghum Silage 5 lbs. Low grade Johnson grass hay	1 lb. C. S. M. 30 lbs. Sorghum Silage 5 lbs. Low grade Johnson grass hay	1 lb. C. S. M. 15 lbs. Sorghum Silage 5 lbs. Good quality Johnson grass hay	1 lb. C. S. 15 lbs. Sorghum 5 lbs. Good qu Johnson grass
Number of Cattle	11 mature cows and 2 year old heifers	14 mature cows and 2 year old heifers	16 calves	15 calves
Initial weight (lbs.)....	1087	1095	400	399
Weight Jan. 20 (lbs.)	1125	1132	435	429
Weight Feb. 27 (lbs.)	1137	1112	454	430
Final weight (lbs.)....	1112	1074	464	451
Loss or gain in Wt. (lbs.)	25	−21	64	52

The cows in Lot I and the calves in Lot III were fed in the beef cattle barn, were turned out in convenient lots about eight-thirty after the morning feed was consumed, and were returned to the barn about five in the afternoon in time for the evening feed. The cows in Lot II were confined in a four acre lot for the wintering period. There was no shelter whatever provided in this lot. A Bermuda sod gave the cattle a comfortable place to lie down and the feed trough was moved occasionally when the ground around the trough became muddy. The calves in Lot IV were confined for the wintering period to a pasture of about forty acres. The topography of this area is somewhat rolling and a small grove of hardwood trees gave very little, if any, protection to the calves. The sod in Lots II and IV furnished no grazing of any consequence during the wintering period until about the middle of March. The small amount of grazing that was available after this time did not influence the cattle's appetites for their ration.

A study of the results tabulated in Table I indicates that the cows under shelter gained on the average of 25 pounds of live weight during the winter, while the cows with no shelter lost 21 pounds. There was very little apparent difference between the two lots at the close of the wintering period, except the coat of hair of the cattle of Lot II was slightly rougher than that in Lot I. There was no apparent difference in physical condition of the cows in Lots I and II that would indicate that the cattle in Lot II suffered for lack of shelter, nor was there any apparent difference in the calves produced by the two lots or the way they developed their young. The changes in live weight of the weanling calves for the wintering period for Lots III and IV are insignificant. Both lots wintered satisfactorily in every way.

The same experiment was repeated for the winter of 1928 and '29. This time yearling cattle were used in Lots III and IV instead of weanling calves.

Table 2 gives the essential data for the second winter:

Table 2—The Effect and the Economic Value of Shelter for Wintering Beef Cattle.
December 12, 1928 to March 27, 1929 (106 Days)

	Lot I Shelter	Lot II No Shelter	Lot III Shelter	Lot IV No Shelter
ation	1 lb. C. S. M. 30 lbs. Sorghum Silage 5 lbs. Low grade Johnson grass hay	1 lb. C. S. M. 30 lbs. Sorghum Silage 5 lbs. Low grade Johnson grass hay	2 lbs. C. S. M. 30 lbs. Sorghum Silage 3 lbs. Low grade Johnson grass hay	2 lbs. C. S. M. 30 lbs. Sorghum Silage 3 lbs. Low grade Johnson grass hay
umber of Cattle	19 mature cows and 2 year old heifers	14 mature cows and 2 year old heifers	23 yearling steers and heifers	15 yearling steers and heifers
itial weight (lbs.)....	1027	1059	539	551
Veight Jan. 14 (lbs.)	1051	1059	574	582
Veight Feb. 14 (lbs.)	1066	1055	607	608
inal weight (lbs.)....	1045	1028	647	622
oss or gain in Wt. (lbs.)	18	−31	108	71

Lots I and II were given the same management and equipment as was used for the first winter's test. Again the mature cows and heifers of Lot I maintained their weight more satisfactorily than similar cattle without shelter. The results for the two winters are very uniform. Lots III and IV for the second winter were maintained on the same areas as were provided for the calves the previous winter. While there is some advantage in the gains in live weight of the yearlings in Lot III over the yearlings that had no shelter, both lots wintered satisfactorily in every way and the only apparent difference in the two groups of cattle at the close of the winter was the slightly rougher coats of hair of the cattle in Lot IV.

It will be necessary to extend this study over several years with the different ages of cattle to draw definite experimental conclusions. However, making a progress report on the basis of two years' work, records indicate that shelter is not necessary in this climate for mature cows, yearlings, or calves if the cattle are in good condition when they go into the wintering period. It would seem that a small addition to the rations fed the cattle without shelter would maintain their weight uniformly with the cattle under shelter and that this increased expense of the ration would be less than the amount of money necessary to furnish and maintain the shelter for the cattle of the different ages. All of the cattle in the four lots for the two winters were in good condition and there was no evidence that any of the groups suffered for lack of shelter.

Feed Bunks. Portable feed bunks are very satisfactory for feeding cattle in the open. The bunks should be built of two inch material and preferably from a quality of lumber that will last for several years. The legs should be cut from four by four inch material and should be bolted and braced to the body. For mature cattle, the bunk should be 32 inches high, 10 inches deep, and 4 feet wide. Three feet of trough space should be provided for each mature cow and two year old heifer. Feed bunks for calves and yearlings should be 24 inches high, 10 inches deep, and 3 feet wide. Two feet of trough space should be provided for each calf and two and one-half feet for yearling cattle. The accompanying illustration indicates a good type of construction.

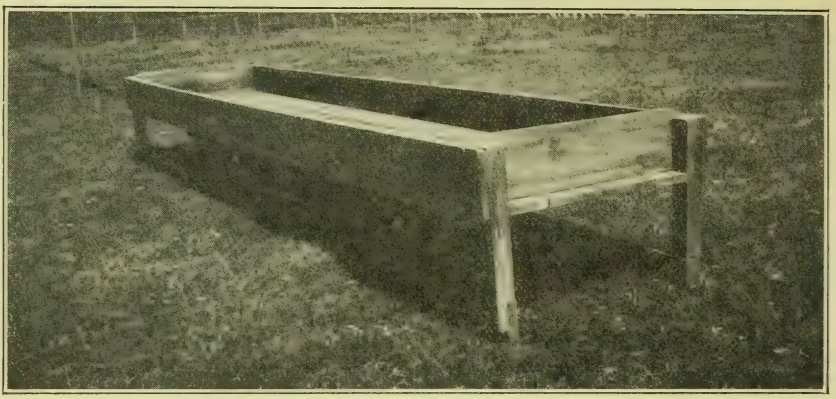


Figure 1—A good type of feed bunk suitable for feeding a ration of cottonseed meal and silage.

Shelter for Storing Feeds. With the present price of concentrated feeds in the South and the type of roughage that is available for beef cattle production, cottonseed meal is the chief concentrate that will be utilized for producing market beef cattle. As this feed is highly concentrated and only small amounts are necessary for wintering the herd, a relatively small space of shelter will be required for housing the concentrated feeds. A sufficient space should be provided for storing the year's supply, if possible, for under normal conditions it is most economical to buy the year's supply between the time of gathering the crop of cotton and the beginning of winter feeding operations.

Silos. Sorghum silage has proved so far to be the cheapest and most satisfactory roughage for wintering the various ages of cattle. The beginner in beef cattle production should make a very careful study of the different types of silos that are being used and consult with the Agricultural Engineering Department of the Mississippi Experiment Station, A. & M. College, Mississippi, for information and advice, bills of material, etc., for constructing silos.

One of the most serious drawbacks in making silage, especially with breeders who have limited capital for starting cattle production, is the necessary amount of money to be invested in equipment to handle the silage crop. Where several neighbors can pool this expense and cooperate in owning the equipment, this handicap is very largely overcome. With the increasing availability of belt power on the farms of the state, this problem is less serious.

Pit silos should be carefully investigated for those sections of the state where the topography of the land and the soil type is of such a nature as to give proper drainage. This type of silo has been successfully used at the sub-station at McNeill, Mississippi, for three years and Mr. S. W. Greene reports that it is very satisfactory in every way. Pit silos require a very small amount of capital for the initial investment, are inexpensive for maintenance, and the silage has been of high quality.

SELECTION OF THE BREED

There is no best breed of beef cattle. The chief differences between the more popular breeds of beef cattle are those of color and breed characteristics. There is more variation between the individuals within a breed than there is between the average individuals of the different breeds. As a rule, a selection of a breed is a matter of personal choice. There would be some advantage, however, in selecting a breed that was popular in the vicinity, as this would facilitate the exchange of herd bulls.

It is not unwise for the beginner to start his cattle breeding operations with native Mississippi cows and a purebred herd bull. Mistakes if made in an undertaking with this kind of investment will not be very costly. The native cows, if wisely selected, will have plenty of capacity for handling feed and produce a sufficient milk supply to develop a desirable grade calf. By mating the correct type of beef bull with these native cows, the best grade heifers can be added to the herd each year to increase the size of the herd and replace the native cows as they approach the end of their usefulness. The majority of the cattle that have been used in the experiments quoted in this bulletin are the result of this type of production. The original herd of cows averaged in breeding flesh from 550 to 650 pounds. Third and fourth top crosses removed from the native foundation herd produced a type of cow that is just as valuable for producing a high quality market steer as could be produced by a great many purebred cows. It will be noted that the present average weight of the mature cattle in the breeding herd is in the neighborhood of 1050 pounds.

THE ABERDEEN ANGUS

The Angus cattle are solid black in color and have no horns. The breed is a model of beef type. They are short of leg, broad and deep of body,

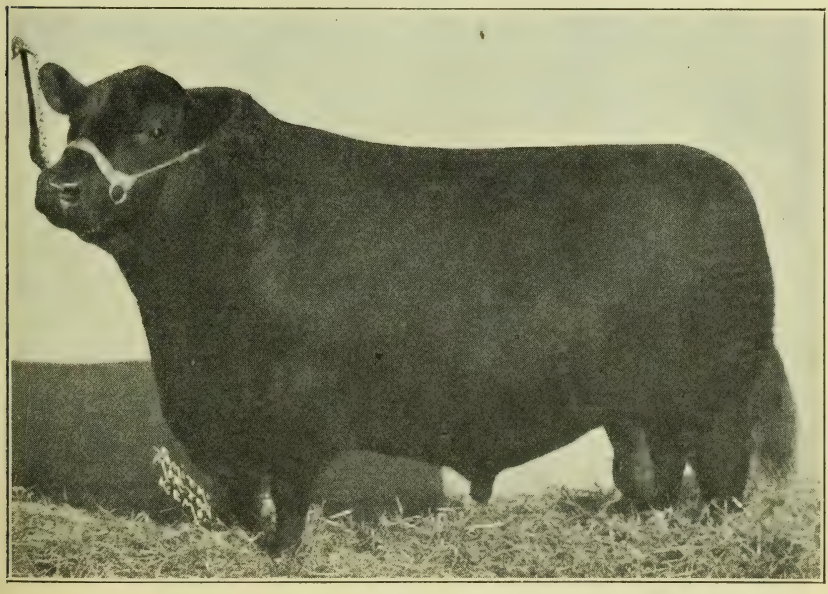


Figure 2—A purebred Aberdeen Angus bull, Playman of Sunbeam 338509.

carrying their breadth and depth uniformly, and are very compactly built. The body is more cylindrical in shape than is characteristic of the Hereford or Shorthorn. The milking qualities of the cows are fair. They are credited with giving more milk than the Hereford, but not as much as the Shorthorn. Cattle of this breed mature very early and have a tendency to fatten well at any age. The breed has an enviable record for high dressing per cent and meat that is well marbled and of first quality. Their merit in these respects has been shown repeatedly in the show ring and in carcass contests.

In size the Angus is smaller than either the Hereford of the Shorthorn. Mature bulls will weigh from 1800 to 2100 pounds and mature cows from 1200 to 1500 pounds. They are somewhat more restless or nervous in their temperament than either the Shorthorn or the Hereford. The breed is becoming more popular in the South and ranks next to the Hereford in this respect and above the Shorthorn.

THE HEREFORD

The Hereford color is distinctive. The body color is a deep, rich red with white head, breast, belly, crest, switch, and legs below the knees and hocks. The body conformation varies slightly from that of the Angus in that they are usually a little fuller in the region of the crops and heart girth. The Hereford cow has been criticized somewhat because of the scanty milk flow, but in most of the cattle of modern breeding this criticism has been removed. They mature early and fatten readily in the feed lot.

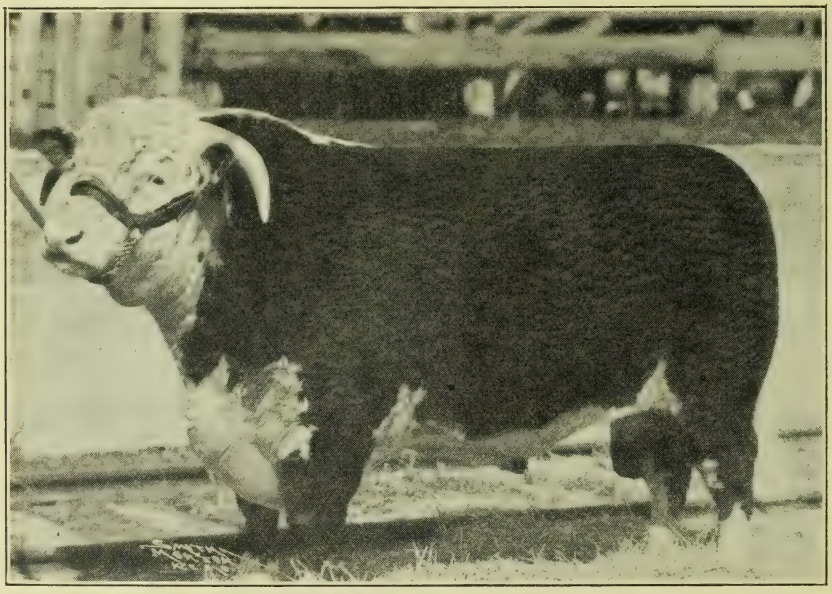


Figure 3—A purebred Hereford bull, Hazford Credit 1456777.

Mature bulls weigh from 1900 to 2200 pounds and mature cows weigh from 1200 to 1600 pounds. The Hereford is noted for its constitution and hardiness. The breed is popular in the South and the breeders have their choice of either the horned or the polled families.

THE SHORTHORN

The Shorthorn breed varies in color, being red, white, and red and white spotted or roan. In conformation the Shorthorn is more rectangular in form than the Angus or the Hereford and the breed carries remarkable development in the round. Of all of the beef breeds, the Shorthorn excels in milk production and for this reason it has become a favorite on small farms where it is desirable for the cows to furnish the family supply of milk and at the same time produce a good beef calf for the market. The Shorthorn has not proved to be as good a rustler under southern conditions as the other two breeds.

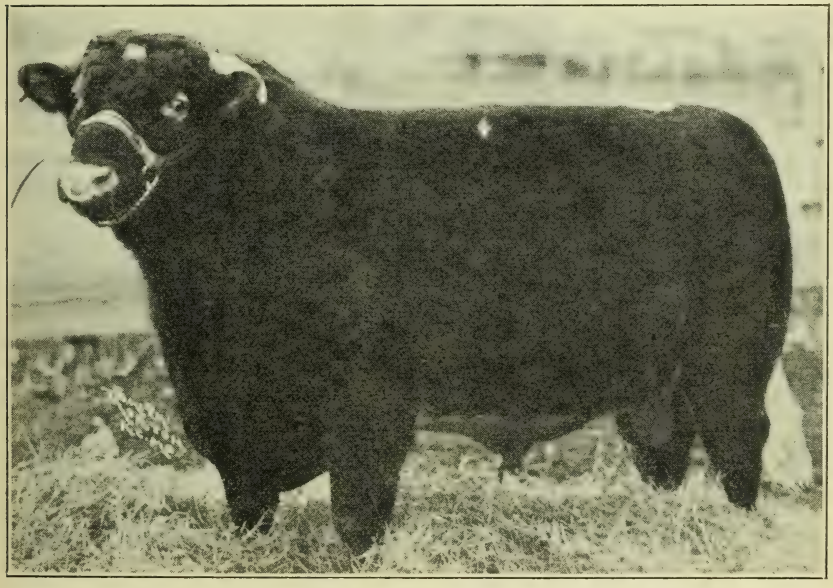


Figure 4—A purebred Shorthorn bull, Maxwalton Referee 1405797.

The Shorthorn is the largest of the beef breeds. Mature bulls weigh from 1800 to 2400 pounds and mature cows from 1300 to 1600 pounds. The breeder has a choice of either the horned or the polled families in this breed.

SELECTING THE COW HERD

The foundation cows for the market herd may be selected from native cows or high grade cows, depending on the amount of money available for the investment. After some experience, the breeder may add a few purebred cows to his herd and gradually build up a purebred herd if his ex-

perience and his market for seed stock justifies developing this type of production. The principle must be kept in mind, however, whether selecting cows for producing market or purebred cattle, that if a good cow bred to a good bull will produce a good calf, a better cow bred to a better bull will produce a better calf. The cows should be as uniform as possible in type to facilitate the selection of a herd bull to improve their common defects. The cows should exhibit quality as indicated by loose, pliable hide and quality of bone. They should carry as much natural flesh as possible. and should have capacity for handling a large amount of feed and a well developed mammary system for producing plenty of milk for the calf. The cows should be selected from herds that are free of abortion, tuberculosis, and other cattle diseases.

SELECTING THE HERD BULL

The herd bull is far more than half of the herd. A cow's inheritance will influence only one calf a year, but the herd bull may influence 20 or 25 times as many individuals a season. If he has been wisely selected and transmits the desirable characteristics to his offspring, the value to the herd, either grade or purebred, will be enhanced very rapidly.

The bull should exhibit marked beef qualities. He should be short of leg, deep and broad of body, compactly built, and carry a wealth of natural flesh of good quality. Bulls for mating with native cows especially should have plenty of substance, but not be of the coarse type. He should exhibit a strong constitution and be vigorous. Milking qualites in the herd are extremely important and this characteristic should not be overlooked in selecting the head of the herd. Use only bulls whose dams are outstanding in this characteristic. Select herd bulls from healthy herds of cattle. It is best to buy bulls that are well developed. Beginners often make the mistake of attempting to buy young calves and develop them. It is usually advisable to invest at least five times the value of the average cow in the herd in making an investment in a herd bull.

CARE OF THE HERD BULL

Outdoor exercise throughout the year is one of the most important essentials for keeping the herd bull in good physical condition. He should have a well fenced pasture of at least two acres and this area should be carefully managed so as to produce a luxuriant growth of both carbonaceous and leguminous pasture plants for as nearly nine months of the year as possible. Succulent pasture grass is the most valuable feed that can be furnished the herd bull.

An inexpensive shelter should be provided for the bull to which he should have free access at all times. Sufficient storage space for feeds and convenience for caring for the bull should be provided in this building.

Usually only one herd bull will be in service at a time on the average Mississippi farm, but it is advisable to have one or two young bulls coming on. The young bulls can be kept with the mature herd bull to good advantage, for the growing bulls will cause the mature bull to take plenty of exercise. In developing young bulls, it will be necessary to supplement

their mother's milk by the time they are a month old and they will need a grain feed in addition to their pasture for developing them to the best advantage. An excellent grain mixture for bulls of all ages is composed of equal parts by weight of shelled corn, wheat bran, and oats. The bull calves will start eating a small amount of this mixture when a month old and will consume more of the grain as they mature, but on the average when on full feed they will require about a pound and quarter of this mixture per hundred pounds live weight daily. The growing calf should have access to a good quality mixed hay in addition to his pasture.

The mature bull when not in service and on good pasture will require little feed in addition. If it becomes desirable to increase his amount of flesh, feed him the same mixture as recommended for the calf, using when on full feed a pound and a quarter per hundred pounds live weight

Figure 5—Herd bull barn on the Mississippi Experiment Station farm.

daily. A pound and a half of this mixture in the ration can be replaced with equal amounts of cottonseed meal. For the mature bull, a pound of good quality mixed hay per hundred pounds live weight daily is sufficient. If silage is used at all for the herd bull it should not exceed one-third of the roughage portion of the ration or the maximum of about 15 pounds daily. The amount of grain or roughage fed to the mature bull should be adjusted with the changing of the season and so regulated as to keep him in good breeding flesh. Give the bulls access to salt and pure water at all times.

If for any reason the bull should fail to settle his cows, give him rest from service, see that he takes plenty of exercise, and correct his physical condition if too thin or too fat. Avoid the use of drugs with herd bulls except under the advice of competent veterinarians.

BREEDING

The bull should be kept away from the herd of cows except during the breeding season. Young bulls should not be started in service until they are 12 to 15 months of age, and it is best not to place the heifers in the breeding herd until they are 24 to 26 months of age. In breeding market cattle in this section, the general practice will be for the herd bull to remain in the pasture during the breeding season. Yearling bulls should not be mated with more than 15 to 18 cows, and mature bulls should not exceed 20 to 25 cows under this system of breeding. With purebred cattle and with small herds of high grade cattle, hand mating may be practiced. Under this system, yearling bulls may be mated with two or three cows a week during the breeding season and mature bulls allowed a service a day for the same period.

The type of production will determine the breeding season. In most cases in this section, spring calves will be preferable. However, under some types of management, fall calves may be more desirable. For the production work reported in this bulletin, the herd was bred for spring calves. As it was desirable for the calves to be dropped on pasture, the herd bulls were turned in the pasture with the cows on the fifteenth of June and removed from the herd on the fifteenth of September. The heat period of a cow lasts from 12 to 24 hours and reoccurs every 21 days. Allowing the bulls to remain in the pasture for three months gives every cow four opportunities to settle with calf. If the bull is potent, the cow should conceive with this number of services. If she fails, some method of correcting the trouble will have to be resorted to and a veterinarian should be consulted. The period from breeding time to calving time is known as the gestation period and in a cow averages from 280 to 285 days.

SUMMER MANAGEMENT OF THE HERD

A herd of approximately one hundred head of Angus, Hereford, and Shorthorn cows, their calves, and yearlings and two year old cattle were available for the experiments reported in this bulletin. Groups of the various ages were selected for the different lots and comparable lots in every case were divided as nearly equal as possible as to breeding, quality, age, and size. The group pictures of the cattle used as a cover design and in the body of the subject matter of the bulletin show the quality and the condition of the breeding herd. Pastures furnish the cheapest source of feed for cattle and in producing commercial cattle this type of feed must be used to the maximum.

THE PASTURES

Eight hundred acres of well improved pastures on the Experiment Station farm were available for these studies. This acreage was divided into six pastures. The native growth on these areas before the pastures were improved consisted very largely of bunch grasses and wire grasses and the native pastures furnished some grazing from March until about the first of July. Pasture improvement work was started in 1906. First the pasture areas were cleared of underbrush, briars, etc. Seed beds were then prepared on the higher portions of the pastures and seeds of 17 different kinds of pasture plants were sown during the first few years of the work.

Twelve of these varieties now furnish a good mixture of carbonaceous and leguminous plants and provide grazing for the full growing season. The average grazing period for the past five years extended from the twenty-sixth of March to the eighteenth of December, or 268 days. During the spring the bulk of the grazing consisted of hop clover, white clover, black medic, wild barley, and Kentucky and annual bluegrass. Small amounts of sweet clover, wild sweet pea, and narrow leaf vetch add to the value of this mixture. Most of these plants have seeded by the latter part of May and early June and by this time Bermuda and paspalum are making considerable growth. Lespedeza comes into the mixture a little later and these three plants furnish the bulk of the grazing for the summer and fall.

Figure 6—Midsummer grazing scene on a Bermuda and lespedeza pasture.

The various ages of cattle were so fed during the wintering period that they would make the maximum utilization of the pastures. The weights of the mature cows naturally varied during the pasture season, due to the cows calving and the lactation period. The average pasture weight for the mature cows and two year old heifers was approximately 1050 pounds. These cattle reached the maximum weight during the latter part of September and early October. The quality of the pasture maintained the desired condition for the breeding herd and they went into winter quarters carrying the proper amount of flesh.

It is the practice during normal seasons to reserve one pasture so as to obtain a heavy growth of grass during the latter part of the summer for use during the late fall. For two out of the five years this practice was very satisfactory, but for three of the seasons, because of the unusually dry weather, it was necessary to move the herd during the last half of November and the early part of December to the meadows and stalk fields to maintain their weight until they went into winter quarters the middle of December. The cattle in all cases received no feed in addition to pasture and their weight and condition indicated excellent grazing. Through the

major portion of the grazing season, the herd would be full and lying in the shade by eight to nine o'clock in the morning and would do little grazing again until in the afternoon.

Figure 7—Breeding herd on a late fall pasture consisting of paspalum, Bermuda, and lespedeza.

The calves that were dropped on pasture during March and April and had no other feed than pasture and their mothers' milk weighed for an average of a five year period 416 pounds when they were weaned in December.

It was necessary to divide the yearling group of cattle at different periods in the fall, as part of these cattle were placed in the feed lot or were removed to other areas, so complete weight records are not available for the entire grazing season.

Table 3 will give the available figures for the gains made by this group of cattle.

Table 3—Pasture Gains Made by Yearling Steers and Heifers.

Year	No. of Steers and Heifers Grazed	Initial Weight on Pasture	Weight periods and average weight per animal						Average Total Pasture Gain (lbs.)	No. of Days on Pasture	Average Daily Gain (lbs.)
		Apr. 9	May 9	June 10	July 10	Aug. 10	Sep. 16	Oct. 10			
1924	19	516	559	606	637	664	681	689	173	185	.93
		Mar. 21	Apr. 17	May 15	June 16	July 15	Aug. 14	Sep. 14	Dec. 18		
1925	17	451	498	532	598	607	610	629	653	202	272	.74
		Mar. 26	Apr. 21	June 24	July 31	Aug. 26	Sep. 23	Oct. 26	Nov. 23		
1926	38	526	569	598	653	675	704	727	721	195	243	.80
		Mar. 9	Mar. 28	Apr. 26	May 25	June 24	July 26	Aug. 27	Dec. 12		
1927	43	427	437	486	535	566	585	620	602	175	279	.63

The average initial weight of the yearling steers and heifers when they were turned on pasture was 480 pounds. The increase in live weight during the pasture season was 186 pounds.

Shade trees were convenient in all of the pastures and gave the cattle the protection and comfort desired. Ponds furnished a dependable supply of water and block salt was available throughout the grazing periods.

WINTER MANAGEMENT OF THE HERD

The wintering period for the six year average, 1924 to 1929, inclusive, extended from the nineteenth of December to the twenty-fifth of March, or 97 days. In planning the rations for the first winter, corn silage was available, but this crop was discontinued after the first year and sorghum used in its place.

Figure 8—38 head of yearling Angus steers and heifers made a pasture gain of 195 pounds per head in 1926.

FEEDS SELECTED AND WHY

Sorghum silage was selected as the chief roughage to use in the rations for the various ages of cattle, for it is the cheapest type of roughage that is being raised in this section, is palatable, and is easily combined with the concentrate part of the feed.

For a three year average, corn gave a yield of 8.01 tons of silage per acre, sagrain a yield of 10.85 tons, and sorghum 19.60 tons. In fattening steers for the market, Mr. D. S. Buchanan of this Station has determined that 100 pounds of good quality corn silage has the feeding equivalent of about 125 pounds of sorghum silage and about 140 pounds of sagrain

silage. Considering the much larger yield per acre of the sorghum silage, together with its slightly lower feeding value as compared with corn silage, this crop has a distinct advantage for economical beef production. The sorghum crop not only yields over twice as many tons of the silage per acre, but this plant is more drouth resistant than the corn plant in this territory. The sorghum used was a large growing variety known as Japanese seeded cane or Honey sorghum, sometimes known locally as Texas seeded ribbon cane.

Johnson grass hay is available in this section and as it is desirable to combine a small amount of a dry roughage with silage in making up rations, limited quantities of this carbonaceous hay were used in the rations for all ages of cattle.

Cottonseed meal is readily available, requires small space for storage, keeps well, and is a very economical source of total digestible nutrients for feeding cattle. It is very palatable and combines nicely with the type of roughage used in the various rations. It was the sole concentrate that was used for the wintering tests. A conveniently arranged cattle barn provided plenty of shelter for the entire herd.

The breeding herd was divided into three groups for the wintering periods. Weanling calves made up one group, yearling cattle a second lot, and the mature cows and two year old heifers were handled as a group. In most cases, the breeding herd was either polled cattle or dehorned. The horned cattle, for the most part, were fed in a separate lot. For best results in feeding cattle during this period of the year, individuals of about the same age and condition should be grouped together. The ration fed to each lot of cattle was divided into two feeds daily. Half of the cottonseed meal and half of the silage made up the morning feed. After the cattle had consumed the morning ration, they were turned in lots about half past eight in the morning and remained out of doors for the entire day. Water from deep wells was available at all times in each of the lots. The evening feed consisted of half of the cottonseed meal, half of the sorghum silage, and all of the hay that was fed in the ration. The various groups were returned to the barn about five o'clock in the evening and remained under shelter for the night. A sufficient amount of very low grade hay, pasture clipping or straw was used for bedding and enough of this material was used from time to time to keep the stalls dry and comfortable for the cattle to bed down. Block salt was available in the feed troughs throughout the winter.

WINTERING THE CALVES

The calves were carrying considerable flesh when they were weaned about the middle of December and brought in from the pasture. It was the plan of the production work to use pasture to the maximum and produce cattle as economically as possible. The ration for this group of cattle was so regulated as to cause the calves to make some increase in live weight during the winter. It was considered ideal for this age of cattle to gain on the average from a half to three-quarters of a pound in live weight daily during the wintering period. The calves were not in nearly as high condition when they went on pasture the following spring as they were

when they went into winter quarters, but the increase in live weight was very largely bone and muscular development. The calves came to the spring season in a vigorous, healthy condition and made very satisfactory gains from the time they went on pasture throughout the grazing season. A ration consisting of 1 pound of cottonseed meal, 15 pounds of silage, and 5 pounds of number one Johnson grass hay met these requirements for each of the five winters.

Table 4 gives the detail data for the wintering period for the calves.

Table 4—Wintering Beef Calves. · Five Years Records.

aily ration per calf	Year	No. of Calves	Days fed	Initial weight lbs.	Final weight lbs.	Gain per calf lbs.	Daily gain per calf lbs.	Winter feed cost per calf
lb. Cottonseed meal 5 lbs. Corn silage lbs. No. 1 Johnson grass hay	1923-24	29	102	397	480	83	.81	$8.80
lb. Cottonseed meal 5 lbs. Sorghum silage lbs. No. 1 Johnson grass hay	1924-25	29	95	400	456	56	.59	$6.74
lb. Cottonseed meal 5 lbs. Sorghum silage lbs. No. 1 Johnson grass hay	1925-26	40	101	458	523	65	.64	$7.17
lb. Cottonseed meal 5 lbs. Sorghum silage lbs. No. 1 Johnson grass hay	1926-27	37	80	405	453	48	.60	$5.68
lb. Cottonseed meal 5 lbs. Sorghum silage lbs. No. 1 Johnson grass hay	1927-28	16	100	400	464	64	.64	$7.10
verage of 4 years using sorghum silage			94	416	474	58	.62	$6.67

Cost of Feeds

Cottonseed meal	$40.00 per ton
Corn silage	4.75 per ton
Sorghum silage	2.80 per ton
Johnson grass hay, No. 1	12.00 per ton

It will be noted that the initial weight for the five year average of the calves when they went into winter quarters was 416 pounds and the final weight was 474 pounds, or a gain for the wintering period of 58 pounds. This increase in weight gave an average daily gain of .62 pounds for the five years. With cottonseed meal at $40.00 per ton, sorghum silage at $2.80 per ton, and No. 1 Johnson grass hay at $12.00 per ton, the total cost of the feed for the wintering period was $6.67 per calf. The ration was economical, palatable, and satisfactory in every way for calves of this weight.

WINTERING THE YEARLING STEERS AND HEIFERS

The yearling steers and heifers for the most part came into the winter in good condition. The ration was so planned for this group to increase their live weight for the winter in the neighborhood of a pound per head

daily. This increase in live weight was made up almost entirely of bone and muscular development. Steers and heifers fed in this manner went on pasture for their second summer in a vigorous and healthy condition and were able to make maximum development during the grazing season. A ration composed of 1½ pounds of cottonseed meal, 25 pounds of sorghum silage, and 8 pounds of low grade Johnson grass hay met these requirements.

Table 5 reports the detail information for the five winters.

Table 5—Wintering Yearling Steers and Heifers. Five Years Records.

Daily ration per animal	Year	No. per lot	Days fed	Initial weight lbs.	Final weight lbs.	Gain lbs.	Daily gain lbs.	Winter feed cost per yearling
1½ lbs. Cottonseed meal 25 lbs. Corn silage 8 lbs. Low grade Johnson grass hay	1923-24	16	102	618	722	104	1.02	$11.56
1½ lbs. Cottonseed meal 25 lbs. Sorghum Silage 8 lbs. Low grade Johnson grass hay	1924-25	9	95	676	749	73	.77	$8.44
1½ lbs. Cottonseed meal 25 lbs. Sorghum Silage 8 lbs. Low grade Johnson grass hay	1925-26	17	101	653	744	91	.90	$8.97
1½ lbs. Cottonseed meal 25 lbs. Sorghum Silage 8 lbs. Low grade Johnson grass hay	1927-28	10	100	585	704	119	1.19	$8.90
1½ lbs. Cottonseed meal 25 lbs. Sorghum Silage 8 lbs. Low grade Johnson grass hay	1928-29	23	106	539	647	108	1.02	$9.43
Average of 4 years using sorghum silage			100	613	711	98	.98	$8.93

Cost of Feeds

Cottonseed meal	$40.00 per ton
Corn silage	4.75 per ton
Sorghum silage	2.80 per ton
Johnson grass hay, low grade	6.00 per ton

It will be noted that the yearling steers and heifers with an initial weight of 613 pounds gained 98 pounds per head for the wintering period, practically a pound a day. With cottonseed meal at $40.00 per ton, sorghum silage at $2.80 per ton, and low grade Johnson grass hay at $6.00 per ton, it required $8.93 to feed cattle of this age during the winter.

WINTERING MATURE COWS AND TWO YEAR OLD HEIFERS

The heifers were added to the breeding herd about the time they were 24 to 26 months old, so they were included with the mature cows the next fall and were handled with this group from this period on. The calves were weaned about the time the herd was brought into winter quarters.

With the condition that the breeding herd was carrying each fall, it was decided best to plan the rations in such a way as to just about maintain or

increase slightly the live weight of the cows during the winter. A ration of 1 pound of cottonseed meal, 30 pounds of sorghum silage, and 5 to 7 pounds of low grade Johnson grass hay proved satisfactory for wintering these cattle. The variation in live weight for this group during the different winters may be explained in part by the quality of the roughages used each winter.

It will be noted that the choice hay was fed to the calves and the low grade rough hay to the yearling cattle and mature cows. When there was a choice of this material, the better quality hay was usually given to the yearling group. The silages were of good quality each year. Only choice cottonseed meal was used in the rations.

Table 6 gives the detail data for the six wintering periods.

Table 6—Wintering Mature Beef Cows and Two Year Old Heifers. Six Years Records.

Daily ration per cow	Year	No. of cows	Days fed	Initial weight lbs.	Final weight lbs.	Gain per cow lbs.	Daily gain or loss per cow lbs.	Winter feed cost per cow
1 lb. Cottonseed meal 30 lbs. Corn silage 10 lbs. Low grade Johnson grass hay	1923-24	74	102	1002	1054	52	.51	$12.37
1 lb. Cottonseed meal 30 lbs. Sorghum silage 7 lbs. Low grade Johnson grass hay	1924-25	76	95	1043	1030	–13	–.14	$7.88
1 lb. Cottonseed meal 30 lbs. Sorghum silage 5 lbs. Low grade Johnson grass hay	1925-26	55	101	961	1022	61	.60	$7.77
1 lb. Cottonseed meal 30 lbs. Sorghum silage 5 lbs. Low grade Johnson grass hay	1926-27	27	80	997	994	–3	–.03	$6.16
1 lb. Cottonseed meal 30 lbs. Sorghum silage 5 lbs. Low grade Johnson grass hay	1927-28	43	100	1163	1168	5	.05	$7.70
1 lb. Cottonseed meal 30 lbs. Sorghum silage 5 lbs. Low grade Johnson grass hay	1928-29	19	106	1027	1045	18	.17	$8.16
Average of 5 years using sorghum silage			96	1038	1052	14	.15	$7.53

Cost of Feeds

Cottonseed meal	$40.00 per ton
Corn silage	4.75 per ton
Sorghum silage	2.80 per ton
Johnson grass hay, low grade	6.00 per ton

The average weight at the beginning of the winter for the mature cows and two year old heifers was 1038 pounds and they increased during this period on the average 14 pounds per head. There was no case in these records where the rations did not prove satisfactory. The cows delivered normal, healthy calves and developed them nicely.

With cottonseed meal at $40.000 per ton, sorghum silage at $2.80 per ton,

and low grade Johnson grass hay at $6.00 per ton, the winter feed cost for the mature herd was $7.53 per head. While the hay was charged at $6.00 per ton, there was a considerable amount of this roughage that would not have had any market value at all.

THE TEST OF THE MANAGEMENT OF THE BREEDING HERD OF CATTLE FOR THE GRAZING AND WINTERING PERIODS

The real test for any type of feeding and management is not only the weight and condition of the cattle that are produced, but the test is to go a step further and determine what effect the feeding and management will have on the reproductive powers of the herd. Three groups of heifers of the 1924-25-26 calf crops have been developed as outlined in this bulletin for managing the herd during the grazing and wintering periods. These heifers as three year olds have had plenty of substance, have been well developed, have averaged 1000 pounds in live weight, have produced well developed calves, and have made satisfactory brood cows. They represent at this age a total concentrate feed bill of 350 pounds of cottonseed meal—100 pounds fed during the wintering period as calves, 150 pounds as yearling heifers, and 100 pounds for the first winter they were in the breeding herd.

ROUGHAGES FOR WINTERING MATURE COWS

Silage and a carbonaceous hay have been used in the experiments reported above. In a great many cases, the cowman will be interested in other types of roughage for wintering the breeding herd. Where large numbers of cattle are to be handled economically, the author is of the opinion that silage will have to be used; but with the beginner or in handling a small herd of cattle, a silo may not be available or even economical and other types of roughage will have to be employed.

During the winter of 1928-29 an experiment was planned to study the relative feeding value of the principal available roughages that would be adapted for wintering mature cows. As it is the plan to continue this experiment, the following record is in the nature of a preliminary report. Future trials may vary the relative values of some of these roughages. As the ration of 1 pound of cottonseed meal, 30 pounds of sorghum silage, and 5 pounds of low grade Johnson grass hay had proved so satisfactory, this ration was used in this experiment as a check and was fed to the cows in Lot I. A good quality Laredo soybean hay was fed to the cows in Lot II and was used as a sole feed. The cows in Lot III were fed the same amount of cottonseed meal as given to Lot I and 20 pounds of low grade Johnson grass hay per head daily. The cows in Lot IV were fed the same amount of cottonseed meal as Lots I and III and 20 pounds of cottonseed hulls.

The cottonseed meal was charged to the cows at the average market price for the period of 10 years. Sorghum silage was charged at the cost of producing this feed and as there was no market value for this material, $2.80 per ton is the only figure that is available. It will be noted that the soybean hay was charged at the market price for this roughage. This is hardly fair to the feed in comparing it with the silage. If the

figures were available for the cost of producing this hay, it would have been fairer to have used this figure. Low grade Johnson grass hay for the most part was of such quality that it would have had little market value. The cottonseed hulls were charged at the cost delivered on the farm.

Table 7 gives the detail results of this experiment.

Table 7—The Relative Value of Sorghum Silage, Soybean Hay, Johnson Grass Hay and Cottonseed Hulls for Wintering Mature Cows and Two Year Old Heifers.

December 12, 1928 to March 27, 1929 (106 Days)

	Lot I Sorghum Silage	Lot II Soybean Hay	Lot III Johnson Grass Hay	Lot IV Cottonseed Hulls
Ration	1 lb. C. S. M. 30 lbs Sorghum silage 5 lbs. Low grade Johnson grass hay	20 lbs. Soybean hay	1 lb. C. S. M. 20 lbs. Rough Johnson grass hay	1 lb. C. S. M.* 20 lbs. Cottonseed hulls
Number of Cattle	19 mature cows and 2 year old heifers	11 mature cows and 2 year old heifers	19 mature cows and 2 year old heifers	12 mature cows and 2 year old heifers
Initial weight (lbs.)....	1027	1031	1043	1031
Weight Jan. 14 (lbs.)	1051	1062	1059	1034
Weight Feb. 14 (lbs.)	1066	1071	1044	1018
Final weight (lbs.)....	1045	1042	1045	978
Loss or gain in Wt. (lbs.)	18	11	2	−53
Feed cost of wintering per cow	$8.16	$21.20	$8.48	$14.05

Cost of Feeds

Cottonseed meal	$40.00 per ton
Sorghum silage	2.80 per ton
Soybean hay	20.00 per ton
Johnson grass hay, low grade	6.00 per ton
Cottonseed hulls	12.00 per ton

*—Unable to get the cows in Lot IV to consume 20 pounds of cottonseed hulls until December 28. Raised meal to 2 pounds on February 15.

The rations fed to the cows in Lots I, II, and III were very satisfactory and little, if any, difference could be noted in these three groups. There was some anticipation at the beginning of the winter as to whether or not there would be a waste in the soybean hay feeding, for some of the soybean stems were as large at the butt end as a lead pencil; but with the limited amount of hay that was given to this group of cows, the waste of this hay was considered insignificant.

The cottonseed hull ration fed to Lot IV did not prove satisfactory. It was impossible to get the cows to consume the 20 pounds of hulls until they had been on feed 16 days. It was very evident that the ration was not as palatable is it should be, for the cows were uneasy at feeding time and were ravenous for other roughages when they were moved from their own quarters to the scales for the regular weighing periods. One cow lost so much weight that it became necessary to remove her from the lot. On the fifteenth of February it was decided best to increase the cottonseed meal to two pounds per head daily and this amount was continued for the rest of the wintering period. There was some evidence that the increase in the amount of cottonseed meal improved the ration.

WINTER SALT REQUIREMENTS OF MATURE CATTLE

It was noted that steers that were being fattened for the market varied considerably in their salt requirements, depending on the character of the rations that were being fed. To make a further study of the salt requirements of cattle, it was decided during the winter of 1928-29 to keep accurate weights of the salt consumed by the mature cows being fed on different types of roughages to determine what their salt requirements would be. Table 8 gives the results of this study in tabular form.

Table 8—Daily Salt Consumption per 1000 Pounds Live Weight During Wintering Period, Winter 1928-2

Lot number and Ration	Lot I 1 lb. C. S. M. 25 lbs. Sorghum silage 5 lbs. Hay	Lot II 1 lb. C. S. M. 20 lbs. Low grade Johnson grass hay	Lot III 20 lbs. Soybean hay	Lot IV 1 lb. C. S. M. 20 lbs. Cottonseed hulls
No. cows per lot.....	20	20	12	15
Daily salt consumption per 1000 lbs. live Wt.	.44 oz.	1.40 oz.	.67 oz.	1.09 oz.

It will be noted in this record that the daily salt consumption per 1000 pounds live weight varied considerably between the lots fed on the different rations. The lowest consumption, .44 ounce per 1000 pounds live weight daily, occurred in the lot fed on sorghum silage. The heaviest consumption, 1.4 ounces per 1000 pounds live weight, occurred in Lot II with the cows that received the Johnson grass hay ration.

CALVING TIME

The safest place for the cow to deliver a calf is on the pasture. Breeding dates should be so regulated that the cows will calve during the grazing season, if possible. Danger from infection is reduced to the minimum when the calves are dropped on pasture. However, if it becomes necessary for any reason for the cows to calve under shelter, precaution must be taken to have the stall properly disinfected and bedded. Very seldom will beef cows that are in good condition have any complications at the time of calving. They must be watched closely at this period and if for any reason the calf is not delivered promptly they should be given assistance.

DEHORNING

A nicely shaped pair of horns adds to the appearance of the purebred animals of the horned breeds, but the presence of the horns on commercial cattle is very objectionable. Horned cattle require more space at the feed trough and do not feed as uniformly as polled or dehorned cattle. Steers that are hornless are worth from 50 to 75 cents more per hundred weight on the market than horned steers of equal quality. In this climate, horns in the breeding herd are objectionable because the wounds they produce make excellent places for infestation with screw worms. Dehorning should not be attempted during the fly season. All dehorning should be done in the early spring or late fall to avoid trouble from flies.

Breeding. The use of polled bulls is one of the most satisfactory methods for handling the horned problem in the herd. If such a bull is "pure" polled, practically all of his calves will be polled, even though their dams have horns. If, on the other hand, the bull himself is polled in character but is the result of mating a "pure" polled bull with a horned cow, his get from a group of horned cows will on the average be about half polled calves and half horned calves. This will explain why Angus bulls which are "pure" for the polled character seldom sire any but polled calves, while on the other hand polled bulls from the other beef breeds often sire a number of horned calves.

Use of Chemicals. The shock to the animal will be considerably less during and following the operation and there will be much less labor involved if the dehorning is done before the horns come through the skin of the calf. This is best done when the calf is from three to ten days old. Either caustic potash or caustic soda can be used for this purpose. These chemicals can be purchased at almost any drug store and come in the form of a white stick about the size of a blackboard crayon.

To prevent the growth of horns by the use of caustic, the calf should be cast and made secure. Then a pair of scissors should be used to remove the hair as closely as possible immediately over the budding horn. Moisten the end of the stick of caustic very slightly and rub it with a rotary motion on the horn buttons. The rubbing should continue just long enough to irritate the skin over the entire horn area. Enough of the caustic should be left on the skin to penetrate the growing area of the horn and prevent its development. In a few days the thick scab which will appear over the horn button will drop off and the calf will suffer little inconvenience. If the operation has been properly carried out, the head will be as smooth as if the calf were naturally polled. Precaution must be taken not to allow the skin of the operator to come in contact with the caustic at any time. The heads of the calves should be kept dry for at least an hour following the operation to prevent the caustic from coming in contact with the eyes.

Dehorning Older Cattle. After the horns have started to develop, it will be necessary to remove them by either sawing or clipping. The younger the animal is when treated, the better. In cutting off horns, it is necessary to remove a ring of skin from one-eighth to one-half inch with the horn to insure the destruction of the growing area of the horn and to prevent any further growth.

Treatment After Dehorning. Either coal tar or pine tar should be applied to the wound immediately after removing the horn. These materials are non-irritating, adhere well to the skin, and will act as a fly repellent. In spite of all the precautions that may be followed, occasionally the wound may become infested with screw worms. The animal should be watched closely and if the wound begins to show signs of discharge and the animal is uneasy, he should be examined for screw worms. If the worms are present, chloroform poured into the wound will destroy the worms. They should be removed and the wound given another application of tar. Gasoline may be used in the place of chloroform. If the wound becomes

infected by other agencies, it should be cleaned out thoroughly and the area given an application of tar.

CASTRATION

The primary reason for castrating bull calves and making steers of them is to improve the texture, flavor, and tenderness of the beef. Steers are also much quieter in the feed lot than bulls and for this reason feed more satisfactorily.

Time to Castrate. Castration is best done when the calves are from four to ten weeks of age, but it is practical to castrate bulls of any age. The older the animal at the time of the operation, the greater the risk. It is best to perform this operation in the early spring or late fall, so as to avoid trouble from flies infesting the wounds.

Method. Young calves are usually thrown to be castrated. In throwing, the calf should be placed on his left side and the four feet hog tied. The scrotum should be cleaned with a mild disinfecting agent. The operator then grasps the scrotum well up to the belly with the left hand. The left testicle is pulled down and held firmly in the left hand so that the skin of the scrotum is tight over the testicle. With a sharp knife an incision is made on the side of the scrotum next to the leg, starting the incision at the thick part of the testicle and continuing to, but not into, the median line. The seed is thus exposed and is grasped by the right hand and the left is used to separate the gland from the supporting tendons. With the left hand now holding the testicle the cord is pulled down slightly so that it can be severed an inch or two above the testicle.

With calves the cord can be severed by scraping it gradually with the knife until it is worn into. The lacerated ends of the cord so severed reduce materially the hemorrhage. With older cattle the best practice is to use an emasculator. This type of instrument cuts the cord and, at the same time, so lacerates it as to minimize the hemorrhage very materially.

The right testicle is now removed in a similar manner. This method of castration destroys the minimum amount of tissue, it gives complete drainage, it is rapidly performed, and it leaves the scrotum in good form to fill out nicely when the steer is conditioned for the market. There are several different types of incisions that can be used for this operation, but the incision on the side of the scrotum, as outlined above, is the one that is practiced here at the Station and is very satisfactory. Following the operation, it is a good plan to place a small amount of pine tar on the wound to keep away flies and to act as a disinfecting agency. Unless the wound becomes infested with screw worms or maggots, very little after trouble will be experienced. If the wound is infested, drainage should be made complete and the wound washed out with chloroform or gasoline and the tissues again treated with pine tar.

WEANING CALVES

Beef calves will ordinarily be weaned when they are from six to eight months of age. When the calves are removed from their dams, they should be kept away from them once and for all. It is usually the best

practice, if possible, to confine the calves far enough away from their mothers so that they cannot hear them. The practice of turning the calves with their mothers a day or two later to allow them to suck is not good management. The returning of the calves simply prolongs the period that they will worry for their mothers and in some cases the stale milk that the calves will receive will cause digestive troubles. Careful watch must be kept of the udders of the cows for several days following weaning.

RECORDS OF THE HERD

With purebred cattle, it is very important that careful records be kept of each individual in the breeding herd to facilitate recording the calves and keeping up with the breeding operations. Even with a grade herd, a simple form of keeping records of the individual cows in the herd is very desirable. Each cow should be given an ear notch, a tag, or some other method of individual identification. A record made of the individual each time the herd is inspected will give the owner an opportunity to determine accurately which cows are regular breeders. Notes as to the type of calves that are produced will give additional information that will assist very materially when the time of the year arrives to cull the herd.

MARKETING CATTLE

There are two general methods of marketing beef cattle. The producer should acquaint himself with his markets and determine which method will give him the largest probable return for his animals. Selling cattle to the local butcher or buyer, although a common type of marketing, is probably the least profitable to the cowman. These dealers must necessarily buy on a wide margin and the producer loses accordingly. The central markets offer the best medium for the profitable disposal of the cattle of different ages and market condition. The cowman should select a reliable commission firm at one of the central markets and advise him as to the kind of cattle he has to dispose of. The commission man in return will keep the producer posted as to market conditions and give advice as to the most advantageous time for shipping. It is to the advantage of the commision man to obtain as high a price as possible for the shipper's product.

COOPERATIVE SHIPMENTS

For the cowman who is producing cattle in small enough numbers so that he cannot make a car lot shipment at a time, the cooperative shipping association gives an excellent method for marketing his animals. The shipment is usually made in the name of one individual. The cattle for each owner in the cooperative shipment are given a mark for identification either by clipping the hair or using a paint mark on a certain part of the body of the animal. The commission man is furnished information as to the name of each owner, the number of animals he has consigned, and the mark for identifying his animals. On arrival at the central market, the carload is divided according to the ownership of each consignee. The commission man sells the carload of cattle, prorates the marketing expense

on the live weight basis of the shipment, and each consignee receives his individual return.

SHIPPING CATTLE

The car for a shipment should be ordered far enough in advance of the date of shipment to give time for seeing that the car is properly bedded and in good shape before loading. In ordering cars, the local freight agent can furnish information as to freight charges to the different markets. The size of the car that will be needed should be specified. Standard stock cars are eight feet, six inches wide and either 36 or 40 feet long. The 36 foot car is billed with a minimum weight of 22,000 pounds and a 40 foot car with a minimum weight of 24,000 pounds. The shipper must pay the freight on the minimum weight whether his load of cattle comes up to the minimum or not. No maximum weights are specified, but it is to the shipper's advantage in every case to load the car comfortably full. If too small a number of cattle or too large a number are placed in the car, the shrink in transit will be excessive. Thirty-two 1000 pound steers make a comfortable load for a 40 foot car. If it is necessary to ship a small number of cattle in the car, it will be to the owner's advantage to confine them to a portion of the car by the use of a partition.

The law requires that cattle that are in transit for 28 hours must be unloaded, watered, and fed. If the owner wishes his cattle to go direct to the market and they can reach the point of destination in 36 hours, the shipment can be moved without unloading if the owner makes this request of the freight agent at the time of billing the car and signs a release.

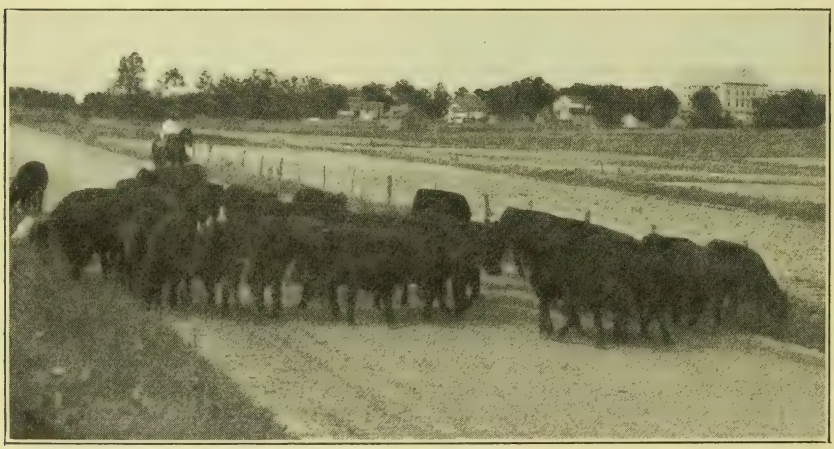


Figure 9—Ready for the Market. Yearling and two year old steer hides furnish excellent packages for marketing home grown roughages. Southern roughages combined with cottonseed meal make a palatable and economical ration for conditioning cattle for the market.

For information on feeding steers, write to the Animal Husbandry Department, Mississippi Experiment Station, A. & M. College, Mississippi.

COMMON AILMENTS

In comparison with other classes of farm animals, beef cattle have very few diseases and disorders. The cowman should acquaint himself with the more prevalent infectious diseases and common ailments in his territory and ever be on the alert for these troubles. Just how much the owner can rely upon his own treatment of the herd will depend on his knowledge of the different diseases. The average man should call on a well qualified veterinarian to handle the diseases that are of an infectious nature. Many excellent articles and bulletins have been written on these diseases and the breeder should familiarize himself with these publications. He should consult his veterinarian, his county agent, or the State Live Stock Sanitary Board at Jackson, Mississippi. The following comments on the more common troubles in the herd are in no way a complete treatise. The statements for each disease are made primarily with the intention of calling the breeders' attention to these conditions that may make their appearance from time to time and assist the cowman somewhat in preventing and controlling infection in the herd that might prove disastrous if neglected.

CONTAGIOUS ABORTION

The native cattle of this territory are more or less free of contagious abortion and it behooves every breeder to use every precaution possible to prevent bringing this dreaded disease into his herd with the purchase of new animals. This disease is caused by specific organisms and the infection usually is introduced through the digestive tract by consuming contaminated feed, drinking water, or by the animals licking contaminated troughs or other infected animals. The more common symptoms are the birth of immature calves, cows failing to conceive, a yellowish discharge, or very weak full time calves that usually die a few days following calving. All animals that are of a suspicious nature should be removed from the herd and kept in isolation for at least three weeks after all signs of discharge disappears. After calving, the dead calf, all foetal membrane and all litter should be carefully burned and the soiled parts of the cow should be thoroughly disinfected. A blood test for contagious abortion makes it possible for the purchaser to have protection from this disease. Only competent veterinarians can handle this test and it would be a wise precaution for the breeder to make purchase of breeding cattle that the test shows to be free of abortion.

TUBERCULOSIS

Tests for tuberculosis on the native cattle of Mississippi show that the herds are remarkably free of this disease. With the traffic that is developing in the cattle industry and the bringing in of breeding cattle from centers in other territories where this disease is prevalent, it becomes necessary for the beef cattle producer to be constantly on the guard against tuberculosis. Indications of the presence of tuberculosis can seldom be diagnosed in the live animal; consequently the tuberculin test is about the only reliable method of diagnosing this disease. Breeding cattle should be purchased when possible from accredited herds. Such herds are under federal sup-

ervision and are free of this disease. In buying cattle from herds that are not accredited, the animals should be purchased subject to the tuberculin test.

ANTHRAX

Anthrax, a disease that is known in certain localities as charbon or splenic fever, is a very infectious and contagious disease. Its presence is usually confined to rather low, moist, poorly drained areas. Death from this disease is very sudden and finding a dead animal in the pasture is usually the first sign of the presence of the disease. Animals that have died suddenly should be treated with suspicion and the carcasses handled with extreme caution until the cause of the death has been determined. The blood of animals that have died of this disease is of a tarry consistency, is of a blackish color, and fails to make firm clots. The spleen of the animal is usually enlarged two to five times its normal size. A positive diagnosis can only be made by examining a sample of blood under a microscope. A veterinarian or the county agent can assist the owner in collecting samples for sending to the State Live Stock Sanitary Board for diagnosis. Carcasses should be burned. In case a positive diagnosis is made, the rest of the herd should be vaccinated promptly and this treatment should be administered only by thoroughly competent hands.

HEMORRHAGIC SEPTICEMIA

While cattle of all ages may be affected with hemorrhagic septicemia, the greatest infection occurs with the younger animals, usually the calves. Animals that are in a run down condition seem to be more susceptible than animals that are in good physical condition. The more common symptoms of the disease are a high body temperature, soft swellings beneath the skin in the region of the throat and neck, the swelling of the tongue, and a mucous discharge from the nose and mouth. A post mortem examination usually reveals blood spots on the lungs, on the walls of the intestines, and in the fatty tissues that surround the kidneys. Treatment of animals that are affected with this disease is useless as a rule. Its spread to the rest of the herd can be prevented by the proper use of immunizing bacterins, by quarantining sick animals, and by proper disinfection.

BLACKLEG

Blackleg is an acute disease that attacks young cattle, usually those between the ages of six and twenty-four months. The characteristic symptoms of this disease are marked lameness and swelling in the region of the shoulder and thigh. This swelling is due to a formation of gas under the hide and if pressure is applied to the swollen place, a peculiar cracking sound is heard, similar to the sound that is made by crumpling a piece of parchment paper. The disease runs a very rapid course and almost always terminates fatally in 36 hours. Prevention rather than treatment is the most successful way to handle this disease. In those districts where blackleg is prevalent, all cattle between the ages of 6 and 24 months should be vaccinated. One vaccination is sufficient to protect

the animal as long as it is susceptible to the disease. In badly infested areas, calves should be vaccinated when they are about three or four weeks of age.

BLOATING

Bloating is caused by a development of gas in the paunch and is due to some digestive disorder. It is easily recognized by pronounced swelling of the left flank. If the bloat is detected in its early stages of development, a piece of wood fastened in the mouth in the fashion of a bit will give relief. The animal, in attempting to remove the stick, soon starts belching and the gas is removed. A drench of two ounces of turpentine and a pint of water is effective. Should the formation of gas continue after the turpentine has been administered, it may become necessary to relieve the pressure. A very convenient instrument for this operation is a trocar and a cannula. The point of the trocar is placed at a point of equal distance from the last rib, the hip bone, and the lower part of the loin. Pressure enough is exerted to force the trocar through the abdominal wall into the paunch. The trocar is withdrawn from the cannula to allow the gas to escape. The finger should be kept over the end of the cannula to regulate the flow of gas, for if the pressure in the paunch is released too suddenly, it may cause the death of the animal. One to two pounds of Epsom salts dissolved in a half gallon of lukewarm water should be given to the animal as a drench following the recovery from a bad case of bloat.

SCOURS

There are two kinds of scours that attack calves. One of these types is due to bacteria in the digestive tract. Unsanitary surroundings are a predisposing factor in this type. A dose of from four to eight ounces of castor oil, depending on the size of the calf, will check the trouble. The more serious type of this disease is very contagious and is indicated by dirty white, sticky feces which has a strong odor. These symptoms indicate "white scours" and when they develop, a veterinarian should be consulted. Usually the latter form of this disease makes its appearance within the first three days after the calf is dropped.

PARASITES

STOMACH WORMS

In some sections of the state, the pastures are infested with stomach worms. Where a heavy infestation occurs, the calves are unthrifty, make very poor gains, and some losses are experienced. If the calf becomes unthrifty, his coat of hair rough, and the mucous membrane of the eyes very pale, stomach worms should be suspected and the calf treated. The most effective treatment at the present time is to drench the calves with bluestone (copper sulphate). Use a solution for drenching that contains one per cent copper sulphate and one per cent nicotine sulphate (black leaf 40). The solution is made up by dissolving one and a fourth ounces of bluestone in a gallon of water and after the crystals have dissolved adding one ounce of nicotine sulphate. The calves should be kept away from

Bulletin 269. June, 1929.

PROGRESS REPORT

ON

COST OF PRODUCTION ROUTE IN JONES COUNTY, MISSISSIPPI, 1928

By

LEWIS E. LONG, Research Economist

And

J. R. ALLEN, Route Man

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF AGRICULTURAL ECONOMICS

IN COOPERATION WITH

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. COLLEGE, MISSISSIPPI

J. R. RICKS, Director

PROGRESS REPORT
ON
COST OF PRODUCTION ROUTE IN JONES COUNTY, MISSISSIPPI, 1928

This is the second progress report on this project as conducted in Jones County, Bulletin No. 256 of this station contains comparable data for the year 1927. Fifteen farmers cooperated with the Experiment Station in securing the data for this report*. Eleven of these farmers were cooperators in 1927. In addition to the detailed cost data, prices over a number of years were obtained for several commodities which farmers ordinarily buy or sell. Information was also obtained on a number of crops not grown by cooperating farmers by interviewing others who grew them. With the exception of the data pertaining to string beans, this report is based wholly on the detailed account records.

In striking contrast to the 1927 crop season, the 1928 season was very unfavorable for cotton in Jones County. Excessive spring rains delayed farming operations and necessitated much replanting. A part of the fertilizers applied at the time of planting was apparently leached from the soil and excessive rains counteracted the benefits to be had from what was left. Tillage labor requirements were excessive and cotton yields were generally very low. Yields for corn and feed crops were slightly larger

TABLE 1—Financial Statement—Arrayed on Percent Return on Investment—15 Farms, Jones County, Miss.—1928

Farm No.	Total Investment	Crop and Livestock Receipts	Miscellaneous Receipts	Increase in Inventory	Increase in Growing Crops	Value Items Furnished the Home	Total Value of Products
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1	3974	718.26	370.00	510.73	—	304.03	1903.02
2	6308	1278.07	77.70	—	63.03	533.66	1952.46
3	3942	852.80	425.50	—	—	231.06	1509.36
4	8335	1314.94	168.95	88.52	13.00	318.14	1903.55
5	5303	552.00	26.50	59.20	5.16	524.19	1167.05
6	13374	1900.73	41.30	—	31.94	533.56	2507.53
7	5742	662.82	23.42	—	—	353.60	1039.84
8	4832	636.74	136.60	213.03	—	401.08	1387.45
9	8652	2264.11	117.85	—	37.72	552.90	2972.58
10	2875	366.28	36.25	202.52	10.73	401.76	1017.54
11	3719	318.40	101.75	—	—	308.04	728.19
12	2859	353.24	304.01	—	—	265.82	923.07
13	6844	662.87	26.25	—	—	378.20	1067.32
14	3344	610.90	101.75	—	—	458.48	1171.13
15	3080	320.34	125.00	—	—	197.65	642.99
Ave.	5546	854.17	138.86	71.60	10.77	384.14	1459.54

*The cooperating Farmers were: B. S. Crosby, J. W. Everette, L. L. Folks, A. B. Graham, V. G. Hinton, I. C. Odom, J. P. Odom, W. E. Odom, A. E. Patrick, S. W. Rainey, J. F. Stockman. A. W. Tisdale, C. B. Walters. H. G. Walters, and E. M. Watkins.

TABLE 1—(Continued)

Cash Expense	Decrease in Inventory	Decrease in Growing Crops	Value of Family Labor	Value of Board Furnished Labor	Total Charge	Farm Income	Value of Operator's Labor	Return on Investment
Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Percent
886.18	—	—	7.65	5.00	898.83	1004.19	352.80	16.4
810.81	200.00	—	3.60	6.00	1020.41	932.05	408.65	8.3
801.94	95.84	—	35.02	—	932.80	576.56	307.88	6.8
945.19	—	—	58.95	60.00	1064.14	839.41	333.45	6.1
487.11	—	—	64.35	—	551.46	615.59	344.70	5.1
1639.96	19.26	—	134.70	—	1793.92	713.61	265.35	3.4
456.16	78.71	—	98.25	—	633.12	406.72	291.60	2.0
923.36	—	14.22	—	—	937.58	449.87	371.70	1.6
1346.50	1167.03	—	12.00	—	2525.53	447.05	307.72	1.6
457.80	—	—	239.15	—	696.95	320.59	320.55	—
297.34	126.44	30.78	73.80	—	528.36	199.83	281.25	-2.2
643.93	175.71	19.25	—	—	838.89	84.18	274.20	-6.6
1246.40	176.55	—	—	—	1422.95	-355.63	193.28	-8.0
441.93	243.14	48.87	378.22	—	1112.16	58.97	383.02	-9.7
281.44	228.09	—	255.15	—	764.68	-121.69	256.20	-12.3
777.74	167.39	7.54	90.72	4.73	1048.12	411.42	312.82	1.8

than for 1927. A number of the cooperators characterized the season as being the most unfavorable that they had ever experienced.

Field work on the project was discontinued December 31, 1928.

Following the same system as used in preceding Progress Reports, the farms are numbered from 1 to 15, the same number applying to the same farm throughout this report althought different tables may be arrayed on different bases, and farm numbers may not be the same as in 1927.

Some of the principles of good farm management were discussed in the report for 1927. The need and, in some cases, the necessity for their adoption is more clearly evident with the second year's work and when viewed with an unfavorable season as a background. These principles will not be repeated in this report, but it is suggested that the two reports be studied in conjunction. For the sake of convenience, comparable tables are numbered the same in the two reports.

Table 1 shows a condensed financial statement for each of the 15 cooperators together with the return on investment. The return on investment was obtained by subtracting the value of the operator's labor from the farm income, multiplying the remainder by one hundred and dividing the result by the total investment. The array of returns on investments from highest to lowest was used in assigning the numbers to the several farms.

A comparison of this table with the corresponding table for 1927 shows readily how an unfavorable season affects the financial results obtained by the farmer where one crop such as cotton is the principal source. More than one-third of the farms failed to show any return on investment. On the contrary, five farm operators not only failed to make a

return on investment, but were unable to make as much as fifteen cents per hour for their labor. If five percent for the use of land and six percent for the use of working capital should be charged off, only one of the 15 farms would show a profit. Over half of the 19 cooperating farms showed such a profit in 1927.

TABLE 2—Cotton—Cost per Acre and per Pound Lint Arrayed on Cost of Producing Lint 15 Farms—Jones County, Miss.—1928

Farm Number	Acres per Farm	Man Labor	Horse Work	Fertilizers	Other Costs	Gross * Costs	Seed Credit	Net Cost	Yield Lint	Cost per Pound
		Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Lbs.	Cents
4	13.21	13.59	3.74	4.31	4.33	25.97	6.56	19.41	184	10.5
1	10.14	9.16	4.18	4.60	2.93	20.78	3.66	17.21	114	15.1
6	12.18	11.91	5.56	10.66	3.52	31.65	5.00	26.65	172	15.5
3	7.98	16.04	7.19	6.76	4.25	34.24	5.73	28.51	173	16.5
2	12.30	8.50	3.77	8.75	3.56	24.56	4.11	20.47	113	18.1
9	8.70	16.10	7.68	9.20	4.21	37.19	5.67	31.52	144	21.9
10	11.67	29.98	7.62	6.28	5.40	49.28	5.49	43.79	200	21.9
7	8.82	20.30	5.93	5.78	4.39	36.40	4.89	31.51	142	22.1
11	8.58	17.33	4.74	4.28	4.01	30.36	4.08	26.28	113	23.3
14	13.67	20.91	4.07	5.66	3.73	34.37	3.64	30.73	109	28.2
13	5.50	10.71	4.56	8.68	5.46	29.41	3.39	26.02	88	29.6
12	8.79	12.99	7.58	6.36	4.99	31.92	3.55	28.37	84	33.8
8	8.68	11.90	7.13	6.57	3.08	28.68	2.43	26.25	75	35.0
15	20.53	14.78	5.04	5.13	2.98	27.93	1.98	25.95	71	36.6
5	10.15	12.30	5.13	5.60	2.47	26.10	2.22	23.88	62	38.5
Wt. Ave.	10.73	15.28	5.45	6.48	3.84	31.05	4.08	26.97	123	22.0

* Exclusive of land use charge.

Table 2 shows the itemized cost per acre and per pound of lint cotton, exclusive of land use charge, when man labor was valued at 15 cents per hour, machinery use valued at 2 cents per horse hour and other items at going costs or prices. The average yield of 123 pounds of lint per acre was less than the average yield for the state of 176 pounds and the average yield for the United States of 151.8 pounds as reported in December by the United States Department of Agriculture. The same report gave the average farm price in Mississippi, December 1, as 18.5 cents while a later report estimated the average farm price for the United States, December 15, as 18 cents. The weighted average price received by the cooperators was 19.23 cents per pound which though somewhat above the average estimated price for the state, was still nearly three cents below the average cost of production when nothing was allowed for use of land. Only five, or one-third, of the cooperators had costs below the average price received for cotton. The low yield together with a no more than a fair price for the cotton crop accounts largely for the low returns on the year's business since cotton is the principal source of income for the farmers of the community.

TABLE 3—Cotton—Man Labor per Acre by Operations Arrayed on Cost of Producing Lint 15 Farms—Jones County, Miss.—1928

Farm Number	Acres per Farm	Land Preparation	Haul and Apply Fertilizer	Harrow and Plant	Cultivate	Hoe and Chop	Pick	Haul to Gin	Total	Yield Lint
	No.	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Pounds
4	13.21	7.3	6.5	2.9	13.4	29.5	30.2	.8	90.6	184
1	10.14	9.5	1.7	4.1	13.7	16.3	14.8	1.0	61.1	114
6	12.18	4.0	5.6	6.0	18.1	38.0	6.9	.8	79.4	172
3	7.98	14.2	6.6	5.4	24.7	20.9	32.5	2.6	106.9	173
2	12.30	8.1	4.2	2.2	15.1	5.8	19.8	1.5	56.7	113
9	8.70	10.3	5.2	2.8	18.4	27.6	40.2	2.8	107.3	144
10	11.67	14.2	5.5	6.0	33.3	66.6	73.8	.5	199.9	200
7	8.82	10.7	8.8	4.3	25.6	46.8	37.4	1.7	135.3	142
11	8.58	12.6	10.9	4.2	26.0	34.3	25.6	1.9	115.5	113
14	13.67	8.1	3.7	7.3	29.8	38.9	50.2	1.4	139.4	109
13	5.50	11.4	11.6	7.8	8.2	8.2	18.2	6.0	71.4	88
12	8.79	6.3	6.9	5.1	21.3	29.0	13.3	4.7	86.6	84
8	8.68	14.9	8.6	3.2	20.7	10.7	20.3	.9	79.3	75
15	20.53	10.5	3.5	4.3	16.5	45.7	17.2	.8	98.5	71
5	10.15	11.7	5.8	3.9	15.7	23.0	21.4	.5	82.0	62
Wt. Ave.	10.73	10.0	5.8	4.6	20.1	31.5	28.3	1.6	101.9	123

TABLE 4—Cotton—Horse Work per Acre by Operations and Power Machinery Use—All Operations Arrayed on Cost of Producing Lint—15 Farms—Jones County, Miss.—1928

Farm Number	Acres per Farm	Land Preparation	Haul and Apply Fertilizer	Harrow and Plant	Cultivate	Haul to Gin	Total Horse Work	Truck Use	Yield Lint
	Number	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Pounds
4	13.21	9.8	7.3	2.9	13.4	1.5	34.9	—	184
1	10.14	15.2	2.0	4.4	13.7	2.0	37.3	—	114
6	12.18	7.3	4.3	6.0	18.1	1.6	37.3	—	172
3	7.98	27.7	8.3	6.0	24.7	5.2	71.9	—	173
2	12.30	14.4	7.4	2.5	15.4	3.1	42.8	—	113
9	8.70	18.4	9.2	2.8	18.4	5.7	54.5	—	144
10	11.67	22.1	1.4	9.0	33.3	1.0	66.8	—	200
7	8.82	18.7	3.4	4.3	25.6	3.4	55.4	3.1	142
11	8.58	12.6	8.6	4.2	26.0	1.8	53.2	—	113
14	13.67	11.4	1.0	4.7	29.8	2.1	49.0	—	109
13	5.50	12.3	—	7.8	8.2	—	28.3	13.6	88
12	8.79	11.0	—	6.0	21.3	—	38.3	6.1	84
8	8.68	25.1	10.5	3.2	21.3	1.9	62.0	—	75
15	20.53	17.2	.8	4.3	16.5	—	38.8	1.2	71
5	10.15	20.3	5.8	4.2	16.2	1.0	47.5	.4	62
Wt. Ave.	10.73	15.9	4.3	4.7	20.2	1.9	47.0	1.1	123

While the average cotton acreage per farm was less in 1928 than in 1927, the man labor expended per acre on the crop was greater for all operations except picking and hauling to gin as shown by table 2. This may be accounted for by the unfavorable spring which increased the labor of making the crop, and the reduced yield which resulted from the unfavorable season.

Table 4 shows a like condition for horse work. Considerable acreage was abandoned after the land was prepared and, in some cases, planted. Where this preparation was not transferred to another crop, its cost was placed to cotton.

TABLE 5—Cotton—Seed, and Kinds and Amounts of Fertilizer per Acre Arrayed on Cost of Producing Lint—15 Farms—Jones County, Miss.—1928

Farm Number	Acres per Farm	Seed	Fertilizers						Yield Lint
			Super Phosphate	Nitrate of Soda	Cotton Seed Meal	Mixed	Other	Manure	
	Number	Bus.	Pounds	Pounds	Pounds	Pounds	Pounds	Tons	Lbs.
4	13.21	1.0	187	69	—	—	28	—	184
1	10.14	.9	182	128	—	—	—	—	114
6	12.18	.9	—	31	—	545	—	.16	172
3	7.98	.8	331	132	—	—	—	—	173
2	12.30	1.3	33	—	—	455	—	—	113
9	8.70	1.0	205	122	—	—	157	—	144
10	11.67	1.8	223	106	—	—	60	—	200
7	8.82	.8	102	34	—	227	23	—	142
11	8.58	1.4	122	122	—	—	—	—	113
14	13.67	1.0	146	146	—	—	59	—	109
13	5.50	.5	18	135	—	291	—	—	88
12	8.79	1.3	—	—	—	353	114	—	84
8	8.68	1.2	288	153	—	—	—	—	75
15	20.53	1.0	—	—	—	317	—	—	71
5	10.15	1.0	—	—	—	296	—	.89	62
Wt. Ave.	10.73	1.1	114	71	—	177	28	.07	123

The average seed used per acre was .3 of a bushel less in 1928 than in 1927, which may account in part for poor stands and low yields. An average of 390 pounds of commercial fertilizer was applied in 1928 as compared to 335 pounds in 1927, a difference of 55 pounds per acre. During a normal year, this additional fertilizer should have increased the average yield, but the excessive rain with its related evils practically counteracted the beneficial results that could reasonably be expected.

The additional fertilizer applied, the larger amount of man labor and horse work expended, and the low yield obtained, resulted in an average cost per pound of lint of 22 cents as compared to the average of 9.17 cents for the 1927 crop.

Of the mixed fertilizers used, 93.5 percent was 8-4-4 and 6.5 percent had a formula of 10-1.65-2. Other fertilizers consisted of 20 percent muriate of potash, 44 percent kainit, and 36 percent potassium nitrate. The percent-

age of nitrogen in the total fertilizer applied was greater in 1928 than in 1927, a condition which, had the season been normal, should have proved profitable.

TABLE 6—Corn—Cost per Acre and per Bushel Arrayed on Cost of Producing Grain—15 Farms—Jones County, Miss.—1928

Farm Number	Acres per Farm	Man Labor	Horse Work	Fertilizers	Other Costs	Total Costs *	Yield per Acre	Cost per Bushel
	Number	Dol.	Dol.	Dol.	Dol.	Dol.	Bushels	Dol.
9	6.66	8.76	6.75	4.13	1.30	20.94	47.9	.44
6	13.38	5.19	4.54	3.53	.72	13.98	28.0	.50
3	9.05	5.06	3.63	3.70	.90	13.29	25.5	.52
13	2.30	3.00	3.70	4.46	.95	12.11	21.7	.56
12	5.33	6.82	8.28	2.92	1.34	19.36	28.1	.69
1	5.80	8.14	7.26	5.87	1.49	22.76	31.0	.73
14	9.99	9.69	3.80	2.45	1.11	17.05	21.3	.80
4	5.51	9.42	7.03	8.65	1.51	26.61	32.1	.83
10	3.30	15.63	9.92	8.50	1.97	36.02	38.2	.94
7	6.81	9.06	5.98	6.51	1.78	23.33	24.5	.95
8	8.60	6.58	6.37	3.26	1.43	17.64	16.5	1.07
2	10.95	3.99	2.82	4.00	1.01	11.82	11.0	1.07
5	4.42	7.77	7.08	1.04	1.48	17.37	14.9	1.16
11	6.12	7.20	3.20	2.55	.84	13.79	9.9	1.39
15	7.05	5.29	4.64	3.02	.81	13.76	8.9	1.54
Wt. Ave.	Per Farm 7.02	7.05	5.26	4.05	1.17	17.53	23.2	.76

* Exclusive of land use charge.

Table 6 gives the cost per acre and per bushel of producing corn. A comparison with the data for 1927 shows the cost was somewhat greater in 1928, and although there was a small average increase in yield per acre, this increase was not sufficient to lower the cost per bushel. There was a greater range in the yield per acre in 1928 than in 1927, and likewise a greater range in the costs per bushel. The conditions can perhaps be accounted for in part by the unfavorable crop season.

The average yield of corn per acre for the state was 13 bushels and the average farm price, December 1, was $1.02 as estimated by the United States Department of Agriculture. It appears that ten, or two-thirds, of the cooperators produced corn for less than the average farm price where land use cost is not included. The decrease in cost per bushel as the yield per acre increases is strikingly brought out in table 6.

As shown by tables 7 and 8 the average total man labor and horse work expended on the corn crop was greater in 1928 than in 1927. Only two items, man labor for hoeing and harvesting, were less in 1928 than in 1927. The small acreage per farm which would permit more time to be applied per acre and the unfavorable weather perhaps accounts largely for the differences. It is probable that farm 13 expended more man labor and horse work on the crop than was reported.

TABLE 7—Corn—Man Labor per Acre by Operations Arrayed on Cost of Producing Grain 15 Farms—Jones County, Miss.—1928

Farm Number	Acres per Farm	Land Preparation	Haul and Apply Fertilizer	Harrow and Plant	Cultivate	Hoe	Pull and Haul	Total	Yield
	Number	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Bushels
9	6.66	15.0	2.3	12.9	9.5	4.5	14.2	58.4	47.9
6	13.38	6.9	2.4	1.4	9.9	5.0	9.0	34.6	28.0
3	9.05	8.9	2.9	4.1	10.1	1.1	6.6	33.7	25.5
13	2.30	11.3	1.4	3.0	—	—	4.3	20.0	21.7
12	5.33	12.0	.9	4.3	12.9	3.8	11.6	45.5	28.1
1	5.80	17.2	2.9	4.5	22.9	1.6	5.2	54.3	31.0
14	9.99	6.7	4.0	3.5	27.9	10.9	11.6	64.6	21.3
4	5.51	15.1	1.9	6.8	23.8	.5	14.7	62.8	32.1
10	3.30	22.1	9.0	17.3	21.2	15.2	19.4	104.2	38.2
7	6.81	14.9	11.8	2.2	16.7	7.3	7.5	60.4	24.5
8	8.60	12.9	2.5	6.4	13.4	.6	8.1	43.9	16.5
2	10.95	7.8	.8	4.6	7.9	.9	4.6	26.6	11.0
5	4.42	17.6	3.2	5.2	19.7	1.1	5.0	51.8	14.9
11	6.12	13.1	3.4	4.5	17.2	3.3	6.5	48.0	9.9
15	7.05	5.1	2.3	4.8	16.6	6.5	*	35.3	8.9
	Per Fm.								
Wt. Ave.	7.02	11.2	3.2	5.1	15.1	4.1	8.3	47.0	23.2

* Fed from field.

TABLE 8—Corn—Horse Work per Acre by Operation and Truck Use—All Operations Arrayed on Cost of Producing Grain—15 Farms—Jones County, Miss.—1928

Farm Number	Acres per Farm	Land Preparation	Haul and Apply Fertilizer	Harrow and Plant	Cultivate	Pull and Haul	Total Horse Work	Truck Use	Yield Per Acre
	Number	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Bushels
9	6.66	24.0	1.5	6.9	9.5	6.0	47.9	—	47.9
6	13.38	12.4	1.0	1.4	9.8	5.9	30.5	—	28.0
3	9.05	17.2	3.9	2.4	10.1	2.7	36.3	—	25.5
13	2.30	11.3	—	3.0	—	8.7	23.0	1.3	21.7
12	5.33	24.0	—	4.9	12.9	—	41.8	.9	28.1
1	5.80	26.1	1.0	4.5	22.9	10.3	64.8	—	31.0
14	9.99	8.3	1.8	3.4	27.9	4.4	45.8	—	21.3
4	5.51	20.9	1.5	6.8	23.8	12.7	65.7	—	32.1
10	3.30	27.3	6.7	17.3	21.2	14.5	87.0	—	38.2
7	6.81	22.3	10.2	2.2	16.8	4.4	55.9	2.2	24.5
8	8.60	26.0	2.6	7.3	13.7	5.8	55 4	.6	16.5
2	10.95	14.1	1.1	5.9	8.1	2.9	32.1	—	11.0
5	4.42	23.7	6.3	8.0	22.2	5.4	65.6	—	14.9
11	6.12	13.1	.8	3.2	17.2	1.6	35.9	—	9.9
15	7.05	10.2	2.8	6.1	16.6	*	35.7	—	8.9
Wt. Ave.	7.02	17.7	2.6	4.9	15.3	5.0	45.5	.3	23.2

* Fed from field.

TABLE 9—Corn—Seed, and Kinds and Amounts of Fertilizer per Acre—Arrayed on Cost of Producing Grain—15 Farms—Jones County, Miss.—1928

Farm Number	Acres per Farm	Seed	Fertilizers					Yield per Acre
			Super-Phosphate	Nitrate of Soda	Cotton Seed Meal	Other	Manure	
	Number	Pounds	Pounds	Pounds	Pounds	Pounds	Tons	Bushels
9	6.66	12.6	300	60	—	—	—	47.9
6	13.38	4.2	—	135	—	—	—	28.0
3	9.05	6.2	—	141	—	—	—	25.5
13	2.30	6.1	—	141	—	—	—	21.7
12	5.33	10.5	—	131	—	—	—	28.1
1	5.80	7.2	181	112	78	—	—	31.0
14	9.99	7.0	—	93	—	—	—	21.3
4	5.51	7.6	374	176	—	13	—	32.1
10	3.30	8.5	194	261	—	—	—	38.2
7	6.81	4.1	191	147	—	59	.22	24.5
8	8.60	6.5	93	93	—	—	—	16.5
2	10.95	10.2	91	16	—	146	—	11.0
5	4.42	6.3	—	—	—	68	—	14.9
11	6.12	4.6	—	100	—	—	—	9.9
15	7.05	4.0	—	—	—	184	—	8.9
Wt. Ave.	Per Farm 7.02	6.9	84	100	4	35	.01	23.2

TABLE 10—Hay—Cost per Acre and per Ton—Arrayed on Costs per Ton—10 Crops—Jones County, Miss.—1928

Farm Number	Acres per Farm	Man Labor	Horse Work	Fertilizer	Other Costs	Total Cost *	Yield per Acre	Cost per Ton
	Number	Dollars	Dollars	Dollars	Dollars	Dollars	Tons	Dollars
				Oats				
2	2.91	2.84	1.76	—	1.95	6.55	1.29	5.08
12	3.89	3.96	3.05	—	2.87	9.88	1.54	6.42
5	4.59	1.65	1.18	—	3.10	5.93	.87	6.82
4	3.19	2.86	3.39	—	2.39	8.64	.94	9.19
1	1.32	3.06	4.05	.88	3.75	11.74	1.14	10.30
9	5.62	4.22	3.78	2.67	2.34	13.01	.53	24.55
Wt. Ave.	3.59	3.16	2.78	.75	2.64	9.33	.99	9.42
				Lespedeza				
2	13.70	5.22	2.54	—	1.11	8.87	1.56	5.69
				Meadow				
8	2.04	1.84	2.82	—	.49	5.15	.74	6.96
				Soybeans				
4	3.19	2.53	1.60	.94	2.44	7.51	.49	15.33
				Peas and Sorghum				
2 & 5	4.89	5.80	4.81	—	5.43	16.04	.98	16.37
Wt. Ave. All Hay	4.53	3.97	2.85	.42	2.37	9.61	1.11	8.66

* Exclusive of land use charge.

Slightly more seed per acre of corn was used in 1928 than in 1927. There was also a marked increase in the average application of commercial fertilizer, the average per acre amounts being 223 and 170 pounds for 1928 and 1927 respectively, an increase of 53 pounds. The average application in 1928 also carried a higher percentage of nitrogen, a change which the Experiment Station has been recommending.

Of the fertilizers listed under the heading of "Other", 66.6 percent was 8-4-4, 18.1 percent was 10-1.65-2, 12.5 percent was kainit, and 2.8 percent was muriate of potash.

Table 10 shows the cost of producing ten crops of hay of various kinds. Oat hay was the only kind of which enough records were available to make a comparison with results of 1927. The yield per acre in 1928 was .99 tons as compared to .39 tons in 1927 and the costs per ton were $9.42 and $23.12 respectively. For all hay crops combined the average yield for 1928 was .37 tons greater than in 1927 while the average cost per ton was $7.29 less.

The average yield per acre of all hay for the state was 1.24 tons and the average December 1 farm price was $14.97 as estimated by the U. S. Department of Agriculture. Although the average yield per acre for the ten farms shown was .13 tons less than the average for the state, the average cost of production was $6.31 below the estimated farm price. Conditions in Jones County were favorable for hay in 1928, but even with less

TABLE 11—Hay—Man Labor per Acre by Operations—Arrayed on Costs per Ton—10 Crops—Jones County, Miss.—1928

Farm Number	Acres per Farm	Prepare Land and Plant	Fertilize	Harvest and Haul	Total Labor	Yield per Acre
	Number	Hours	Hours	Hours	Hours	Tons
			Oats			
2	2.91	6.5	—	12.4	18.9	1.29
12	3.89	9.4	—	17.0	26.4	1.54
5	4.59	4.4	—	6.6	11.0	.87
4	3.19	12.8	—	6.3	19.1	.94
1	1.32	15.1	—	5.3	20.4	1.14
9	5.12	17.7	1.1	9.3	28.1	.53
Wt. Ave.	3.59	11.0	.3	9.8	21.1	.99
			Lespedeza			
2	13.70	4.0	—	30.8	34.8	1.56
			Meadow			
8	2.04	4.9	—	7.4	12.3	.74
			Soybeans			
4	3.19	9.4	—	7.5	16.9	.49
			Peas and Sorghum			
2 & 5	4.89	11.5	—	27.2	38.7	.98
Wt. Ave. All Hay	4.53	8.1	.1	17.8	26.0	1.11

TABLE 12—Hay—Horse Work per Acre by Operations—Arrayed on Costs per Ton—10 Crops—Jones County, Miss.—1928

Farm Number	Acres per Farm	Prepare Land and Plant	Fertilize	Harvest and Haul	Total Work	Yield per Acre
	Number	Hours	Hours	Hours	Hours	Tons
			Oats			
2	2.91	13.1	—	6.9	20.0	1.29
12	3.89	15.4	—		15.4	1.54
5	4.59	6.5	—	4.4	10.9	.87
4	3.19	25.4	—	6.3	31.7	.94
1	1.32	30.2	—	6.0	36.2	1.14
9	5.62	13.3	—	13.5	26.8	.53
Wt. Ave.	3.59	15.0	—	6.7	21.7	.99
			Lespedeza			
2	13.70	8.0	—	28.9	28.9	1.56
			Meadow			
8	2.04	9.8	—	14.7	24.5	.74
			Soybeans			
4	3.19	9.4	—	5.6	15.0	.49
			Peas and Sorghum			
2 & 5	4.84	20.9	—	28.2	49.1	.98
Wt. Ave. All Hay	4.53	12.9	—	13.6	26.5	1.11

favorable conditions, it appears that a greater effort to produce hay crops would be desirable. With conditions under the fencing regulations, more rough feed is necessary to support a given amount of livestock than was the case under open range conditions. With a deficit of roughage ordinarily expected in the area, hay production on many Jones County farms could be increased. It is probable that livestock often receive less than they should for optimum results, and a local market at good prices is ordinarily available for any surplus produced.

The total man labor and horse work per acre on hay were a little less in 1928 than for the preceding year although the yield was larger. This was due to all crops being sown broadcast in 1928 thus eliminating the cultivation.

Clipping of weeds on the crop of lespedeza was included in the "Prepare Land and Plant" column, while baling, where performed, was included with "Harvest and Haul".

Only five cooperators kept complete records on sweet potato crops. Their findings are shown in tables 13 and 14. The average acreage per farm was less in 1928 than for the preceding year as was also the average yield per acre. Although the average cost per acre was $3.79 less in 1928 than in 1927, the difference of 44 bushels in the average yield per acre caused a difference in favor of 1927 of 9 cents per bushel in the average cost.

TABLE 13—Sweet Potatoes—Cost per Acre and per Bushel—Arrayed on Cost per Bushel—5 Crops—Jones County, Miss.—1928

Farm Number	Acres per Farm	Man Labor	Horse Work	Fertilizer	Other Costs	Total Costs *	Yield per Acre	Cost per Bushel
	Number	Dollars	Dollars	Dollars	Dollars	Dollars	Bushels	Dollars
10	.23	28.05	17.84	18.69	11.82	76.40	283	.27
2	.47	7.04	1.87	5.51	.43	14.85	53	.28
12	.27	36.64	19.05	—	9.33	65.02	185	.35
5	1.21	14.98	8.56	—	8.20	31.74	85	.37
4	.62	22.00	5.00	8.60	.93	36.53	48	.76
Wt. Ave.	.56	18.38	8.43	4.36	5.69	36.86	97	.38

* Exclusive of land use charge.

The U. S. Department of Agriculture's estimate of the yield and December 1 farm price for the state was 110 bushels per acre and 90 cents. Comparative figures for the United States were 95.9 bushels and 93.6 cents. It is again shown that, at least, a small acreage of sweet potatoes is a paying crop for Jones county and similar areas.

Table 14 shows that expenditures of both man labor and horse work on sweet potatoes were considerably greater in 1927 than in 1928. Although the expenditure per acre for fertilizer averaged slightly greater in 1928,

TABLE 14—Sweet Potatoes—Man Labor and Horse Work by Operations—Arrayed on Cost per Bushel—5 Crops—Jones County, Miss.—1928

Farm Number	Acres per Farm	Bed Seed	Prepare Land and Fertilize	Transplant	Cultivate and Hoe	Harvest	Total	Yield per Acre
	Number	Hours	Hours	Hours	Hours	Hours	Hours	Bushels
Man Labor per Acre								
10	.23	—	17.4	78.3	8.7	82.6	187.0	283
2	.47	—	4.3	6.4	8.5	27.7	46.9	53
12	.27	22.2	40.7	14.8	18.5	148.1	244.3	185
5	1.21	—	29.7	6.6	19.0	44.6	99.9	85
4	.62	9.7	16.1	41.9	14.5	64.5	146.7	48
Wt. Ave.	.56	4.3	22.5	21.1	15.3	59.3	122.5	97
Horse Work per Acre								
10	.23	—	34.8	—	—	121.7	156.5	283
2	.47	—	4.3	—	8.5	8.5	21.3	53
12	.27	—	40.7	—	18.5	37.0	96.2	185
5	1.21	—	34.7	—	14.9	29.7	79.3	85
4	.62	—	16.1	—	14.5	16.1	46.7	48
Wt. Ave.	.56	—	26.1	—	12.9	31.4	70.4	97

the smaller amount of labor on the crop may partially account for the lower yield.

The fact that only five cooperators kept accurate records while practically all cooperators produced some sweet potatoes indicates that this crop is considered as rather unimportant in the farming system. Sweet potatoes were included with Truck and Garden where the record was incomplete.

TABLE 15—Sugar Cane—Cost per Acre and per Gallon Syrup—Arrayed on Costs per Gallon Syrup—4 Crops—Jones County, Miss.—1928

Farm Number	Acres per Farm	Man Labor	Horse Work	Fertilizer	Other Costs	Gross Costs	Seed Cane Credit	Net Cost	Yield per Acre	Cost per Gallon
	No.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Gals.	Dols.
3	.42	38.92	11.67	16.33	85.64	152.56	35.71	116.85	238	.49
7	.08	48.75	24.12	25.00	135.75	233.62	78.12	155.50	250	.62
12	.50	48.30	8.32	12.36	87.24	156.22	50.00	106.22	138	.77
4	.59	13.22	3.08	6.27	20.24	42.81	14.83	27.98	27	1.04
Wt. Ave.	.40	32.83	8.06	11.79	64.40	117.08	34.59	82.48	129	.64

TABLE 16—Sugar Cane—Man Labor, Horse Work, and Use of Truck per Acre—Arrayed on Cost per Gallon of Syrup—4 Crops—Jones County, Miss.—1928

Man Labor

Farm Number	Acres per Farm	Prepare Land and Plant	Apply Fertilizer	Cultivate	Strip and Cut	Haul	Total Labor	Yield per Acre
	No.	Hours	Hours	Hours	Hours	Hours	Hours	Gals.
3	.42	31.0	*	57.1	97.6	73.8	259.5	238
7	.08	137.5	*	62.5	62.5	62.5	325.0	250
12	.50	80.0	10.0	120.0	80.0	32.0	322.0	138
4	.59	20.3	5.1	20.3	33.9	8.5	88.1	27
Wt. Ave.	.40	47.8	5.0	63.5	66.7	35.8	218.8	129

Horse Work

Farm Number	Acres per Farm	Prepare Land and Plant	Apply Fertilizer	Cultivate	Haul		Total Horse Work	Yield per Acre
					Horses	Truck		
	No.	Hours	Hours	Hours	Hours	Hours	Hours	Gals.
3	.42	38.1	*	31.0	47.6	—	116.7	238
7	.08	37.5	*	62.5	125.0	—	225.0	250
12	.50	4.0	—	38.0	—	32.0	42.0	138
4	.59	5.1	—	6.8	16.9	—	28.8	27
Wt. Ave.	.40	15.1	—	25.8	25.1	10.1	66.0	129

* Included in prepare land and plant.

Four cooperators kept complete records on sugar cane in 1928, the data being shown in tables 15 and 16.

The cost per gallon of syrup given in table 15 is exclusive of land use charge.

It will be noticed that no man labor or horse work for making syrup are shown in table 16 as was done in the 1927 report. Ordinarily this work is not performed on the farm where the cane is grown, but is done at a neighborhood mill for a toll charge of one-fourth of the syrup. In this report the syrup paid as toll was valued at 90 cents per gallon and included with "other costs" instead of appearing in labor and work costs as in bulletin 256.

The United States Department of Agriculture estimated the average yield per acre for the state as 200 gallons and the December 1 farm price as 90 cents. This estimate does not state whether this yield was exclusive of seed cane saved or not. Comparative figures for the United States are an average yield of 192.8 gallons and an average price of 76.2 cents.

Although the four farms shown had an average yield per acre below both the state and the United States, their average cost per gallon was such that the crop would have been profitable had the syrup all been sold at the average December 1 farm price for the United States of 76.2 cents. It will be noted that seed cane saved is credited against the gross cost so that the cost per gallon is based on the net cost of producing the syrup. It is evident that a small acreage of sugar cane is a profitable crop for those Jones County farmers who can keep their costs within the average shown for the four crops on which detailed cost records were kept.

TABLE 17—Gardens—Cost by Items and Sales of Garden and Truck Crops—15 Farms—Jones County, Miss.—1928

Farm Number	Acres per Farm	Man Labor	Horse Work	Seeds and Plants	Land Use Charge	Fertilizer	Total Cost	Amount of Sales	Net Cost	Net Profit
	No.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.
1	.20	8.55	7.45	—	.80	1.28	18.08	7.00	11.08	—
2	.92	7.80	1.80	2.00	3.68	8.55	23.83	14.47	9.36	—
3	.38	.75	.50	—	.91	2.95	5.11	.75	4.36	—
4	.44	13.50	3.74	1.50	1.76	4.00	24.50	41.30	—	16.80
5	2.32	31.35	23.98	2.00	11.14	23.41	91.88	87.96	3.92	—
6	.26	10.58	7.82	1.80	1.25	3.00	24.45	—	24.45	—
7	.38	2.85	1.07	.65	1.22	2.00	7.79	—	7.79	—
8	.73	19.50	10.92	3.10	1.46	13.45	48.43	15.44	32.99	—
9	.48	2.25	1.41	1.30	1.92	2.00	8.88	—	8.88	—
10	.33	19.20	12.08	—	1.58	10.11	42.97	4.72	38.25	—
11	.55	9.75	5.07	1.50	2.64	13.87	32.83	—	32.83	—
12	.95	9.75	7.49	3.50	1.49	17.05	39.28	10.95	28.33	—
13	.10	.15	—	.25	.33	3.84	4.57	—	4.57	—
14	.39	15.00	6.60	.95	.94	2.50	25.99	1.10	24.89	—
15	.17	1.65	.91	—	.41	3.25	6.22	—	6.22	—
Average Per Farm	.57	10.18	6.05	1.24	2.10	7.41	26.98	12.24	15.86	1.12
Weighted Average		17.75	10.56	2.16	3.66	12.94	47.07	21.36	27.66	1.95

Table 17 shows the items expended on the garden and such truck crops as were not tabulated separately, together with receipts from these enterprises. While the garden produce was charged to the household and credited to the farm at its net cost, it is probable that the net saving in grocery bills due to the garden was really much more.

The average acreage in garden per farm was less than half as much

TABLE S. B. 1—String Beans—Fertilizer and Seed Used per Acre—9 Farms—1927—1 Farm—1928—Jones County, Miss.

Farm Designation	Crop Acres	Fertilizers							Seed		Yield
		Cotton Seed Meal	Acid 16%	Nitrate	8-4-4	12-4-4	10-2-2	Total Cost	Amount	Cost	
	No.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Dols.	Lbs.	Dols.	Lbs.
A	1.50	—	—	—	1000	—	—	14.50	40	7.20	1117
B	3.00	—	—	—	—	883	—	16.67	40	7.20	1500
C	1.50	—	—	67	—	—	667	10.00	53	9.60	2200
D	4.00	—	—	—	1000	—	—	17.50	40	7.20	1600
E	1.25	—	—	—	—	1200	—	19.80	38	6.91	3424
F	1.28	—	—	—	859	—	—	13.16	47	3.28	1703
G	1.00	200	400	—	—	—	—	7.10	40	7.20	2836
H	6.00	200	400	—	—	—	—	6.70	42	7.50	2333
I	1.00	—	—	—	1000	—	—	19.00	40	7.20	2300
J	1.00	500	500	—	—	—	—	16.75	40	7.20	2820
* Wt. Ave.	2.15	238	412	67	977	941	667	13.07	42	7.20	2057

* Of those using respective items.

TABLE S. B. 2—String Beans—Man Labor and Horse Work per Acre—9 Farmers' Estimates—1927—1 Actual Record—1928—Jones County, Miss.

Farm Designation	Crop Acres	Man Labor			Horse Work	Yield
		Pre-harvest	Harvest	Total		
	Number	Hours	Hours	Hours	Hours	Pounds
A	1.50	17.0	40.0	57.0	21.0	1117
B	3.00	36.3	*	36.3	40.0	1500
C	1.50	41.3	40.0	81.3	40.0	2200
D	4.00	44.5	92.0	136.5	39.0	1600
E	1.25	47.2	160.0	207.2	62.0	3424
F	1.28	40.6	73.4	114.0	45.3	1703
G	1.00	36.0	36.0	72.0	31.0	2836
H	6.00	30.0	*	30.0	40.0	2333
I	1.00	37.0	100.0	137.0	46.0	2300
J	1.00	39.5	**	39.5	30.5	2820
Wt. Average	2.15	36.1	79.6***	—	39.5	2057

* Contract at 75 cents per hundred.
** Contract at 80 cents per hundred.
*** Of those reporting time.

in 1928 as it was in 1927, being .57 and 1.40 acres respectively. Both the average cost per farm and the weighted cost per acre were less in 1927, and it is probable that the contributions of the gardens toward the family living were also less.

Tables S.B. 1 and S.B. 2 are not based on detailed cost account records. Only one cooperator kept a record on string beans and it is included. The data were obtained by interviewing farmers who grew beans and it represents their estimates. It is included in this report because a number of farmers of the county are producing string beans and it is thought that the data will be helpful.

Table S.B. 1 shows on a per acre basis the kinds, amounts, and total cost of fertilizer used, the amounts and cost of seed used, and the yields obtained. Table S.B. 2 shows the man labor and horse work expended per acre. It should be noted that land use charge and a charge for containers is not included; nor is there any charge for marketing which might vary considerably because of distance to market and kind of conveyance. These items should be considered in estimating the relative profitableness of string beans as a farm enterprise.

Three cooperators kept detailed costs on Irish potatoes, but a tabulation cannot be shown without divulging individual operations. The total acreage on which records were kept was 3.68 acres with a weighted average yield per acre of 70.1 bushels and an average cost of 75.3 cents per bushel. The itemized weighted average costs per acre were: man labor,

TABLE 18—Workstock—Annual Cost of Maintenance per Animal Unit and Cost per Hour of Horse Work—Arrayed on Cost per Hour of Horse Work—15 Farms—Jones County, Miss.—1928

Farm Number	Animal Units per Farm	Value of Feed	Value of Pasture	Depreciation	Other Costs	Total Costs	Appreciation	Net Costs	Work per A. Unit	Cost per Work Hour
	No.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Hours	Cents
14	2.00	54.06	4.14	—	19.75	77.95	—	77.95	942	8.3
2	2.00	84.90	4.00	—	20.88	109.78	2.50	107.28	1225	8.8
11	1.00	51.00	4.90	—	17.73	73.63	—	73.63	826	8.9
3	3.00	57.66	2.00	13.50	15.75	88.91	—	88.91	891	10.0
4	2.00	67.10	—	—	21.62	88.72	—	88.72	827	10.7
7	2.00	73.85	5.83	2.50	12.98	95.16	—	95.16	890	10.7
5	2.91	40.71	5.97	6.87	15.71	69.26	—	69.26	644	10.8
1	1.50	76.27	2.00	—	26.02	104.29	6.67	97.62	875	11.2
10	1.95	69.23	4.40	—	18.76	92.39	2.31	90.08	789	11.4
8	2.00	61.50	5.00	2.00	16.82	85.32	—	85.32	743	11.5
15	2.00	55.77	2.80	—	17.36	75.93	—	75.93	584	13.0
9	4.00	76.70	1.70	6.50	12.89	97.79	—	97.79	694	14.1
6	5.77	91.85	1.00	4.33	15.05	112.23	—	112.23	753	14.9
13	3.00	68.01	3.83	11.67	19.73	103.24	—	103.24	558	16.1
12	2.22	91.16	6.77	—	17.09	115.02	9.01	106.01	536	19.8
Wt. Av.	2.49	70.40	3.28	3.23	17.06	93.97	1.19	92.78	767	12.1

$16.35; horse work, $5.22; seed, $16.33; fertilizer, $12.88; other costs, $2.01; and total, $52.79. Man labor per acre averaged 108.9 hours and horse work per acre averaged 52.7 hours.

The U. S. Department of Agriculture estimated the yield per acre for the state as 89 bushels and the December 1 farm price as $1.20. Corresponding estimates for the United States were 121 bushels and 54 cents, the latter estimates including the late crops of the northern potato districts.

Those who tried Irish potatoes in Jones county in 1928 were generally disappointed. Yields were below expectations and the prices received were below the above estimated average for the state. A part of the crop was never marketed. In spite of this discouraging experience, a small acreage of early Irish potatoes might prove profitable over a period of years in Jones county. The year 1928 was disastrous for Irish potato growers throughout the United States, and the value of this crop for Jones county should not be judged on this one year's experience.

TABLE 19—Workstock—Annual Quantity Costs per Animal Unit—Arrayed on Costs per Hour of Horse Work—15 Farms—Jones County, Miss.—1928

Farm Number	Animal Units per Farm	Grain Feed				Roughage			Pasture	Man Labor
		Corn *	Oats	Other	Total	Hay	Other	Total		
	Number	Pounds	Pounds	Pounds	Pounds	Tons	Tons	Tons	Days	Hours
14	2.00	2592	—	600	3192	.62	.04	.66	175	51.7
2	2.00	3456	1872	—	5328	.80	—	.80	155	72.0
11	1.00	3384	—	480	3864	—	—	—	190	69.9
3	3.00	3138	—	—	3138	.70	—	.70	60	49.7
4	2.00	2718	—	—	2718	2.22	—	2.22	—	84.2
7	2.00	4122	—	—	4122	.83	—	.83	230	60.4
5	2.91	1002	676	34	1712	.47	—	.47	229	76.8
1	1.50	3084	107	33	3224	1.50	—	1.50	90	60.7
10	1.95	2894	—	—	2894	1.45	—	1.45	180	81.6
8	2.00	3744	—	—	3744	.38	—	.38	200	76.5
15	2.00	2808	—	500	3308	.38	—	.38	120	78.4
9	4.00	4266	—	—	4266	1.00	—	1.00	75	52.1
6	5.77	4766	277	—	5043	1.02	—	1.02	50	46.5
13	3.00	3216	53	200	3469	.90	—	.90	150	64.5
12	2.22	1994	1658	—	3652	1.55	—	1.55	260	82.4
Wt. Ave.	2.49	3307	303	92	3702	.94	—	.94	136	64.1

* In ear unhusked—72 pounds equals 1 bushel.

Table 18 shows the cost per mature animal of keeping workstock, the hours worked per animal, and the cost per hour of such work. The average cost per hour of work was 12.1 cents, 2.7 cents less than the average for 1927. A though the average cost of feed per animal was somewhat higher in 1927, other items were lower. However, the principal item responsible for the lower cost in 1928 was an increase of 118 hours in the average hours work per animal. The increase in the pasture charge over

1927 was due to keeping stock under fence rather than turning them on open range. It was assumed that the manure credit would offset a building charge.

Since the cost per hour of work is determined by dividing the hours worked into the cost of maintenance, an increase in the hours worked must necessarily lower the cost per hour. The advantages of using larger teams as discussed in the 1927 report may again be stressed. Any farmer who considers his own time as being worth more than that of a mule may well consider how he can make his mules perform some of the work which he, himself, has been doing.

TABLE 20—Milk Cows—Annual Cost of Maintenance per Animal Unit and Cost per Pound of Butter Fat—Arrayed on Cost per Pound of Butter Fat—15 Farms—Jones County, Miss.—1928

Farm Number	Animal Units per Farm		Feed and Pasture	Depreciation	Man Labor	Other Costs	Total Costs	Appreciation	Net Costs	Fat per Animal Unit	Cost per Pound Fat
	Total A. U.	Cows	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Lbs.	Cents
12	2.63	1.99	24.63	—	2.83	2.26	29.72	25.13	4.59	62	7.4
4	6.11	3.76	25.23	—	5.68	5.46	36.37	13.30	23.07	115	20.1
9	3.40	1.63	24.93	3.07	7.78	1.75	37.53	—	37.53	184	20.4
7	2.87	2.09	21.92	—	8.27	1.79	31.98	2.39	29.59	142	20.8
10	1.90	1.20	35.45	1.67	12.43	6.25	55.80	—	55.80	254	22.0
8	2.30	1.60	29.36	—	9.40	3.21	41.97	18.75	23.22	93	24.9
1	1.63	1.00	26.95	—	11.90	4.30	43.15	10.00	33.15	125	26.5
6	2.76	2.00	20.54	—	10.00	3.00	33.54	—	33.54	125	26.8
5	4.63	3.00	15.96	.83	7.53	2.47	26.79	—	26.79	100	26.8
2	2.93	1.72	22.86	—	7.54	2.13	32.53	—	32.53	116	28.0
3	3.39	2.30	22.48	2.17	5.77	2.54	32.96	—	32.96	113	29.2
11	4.57	3.35	21.66	—	6.75	4.12	32.53	1.49	31.04	101	30.7
14	2.37	2.12	43.48	—	11.92	3.46	58.86	9.43	49.43	135	36.6
13	2.40	1.78	33.73	1.12	9.96	2.48	47.29	—	47.29	86	55.0
15	3.37	2.33	27.03	—	6.98	1.80	35.81	—	35.81	64	56.0
	Per Farm										
Wt. Ave.	3.15	2.12	25.25	.52	7.78	3.18	36.73	5.33	31.40	115	27.3

Comparing the average annual quantity costs of keeping a work animal in 1927 and 1928 (table 19), it may be noted that for 1928 less corn and more oats and other grain feed was fed, the total being 171 pounds more. This may be due to ordinary variation in feeding or it may be accounted for by the larger amount of time during which the animals were at work. Slightly less roughage, on the average, was fed per animal in 1928, but this was compensated for by additional days on pasture. Feed prices were about the same for both years. It may be said that the amount of feed required per animal for workstock remains fairly constant from year to year as does other expenses such as taxes, interest on investment and man labor expenditures. It is, therefore, good policy to determine the cheapest sources of feed, quality considered, and so use the workstock that the greatest return on the feed and other outlay will be obtained.

Table 20 differs slightly from the comparable table in the 1927 report.

In 1927 only the cows of the farm were considered, all feed and other expense being charged to them and they receiving all credits to cattle. In this report, all costs are based on the total animal units except the cost per pound of fat which is based on the number of cows and the fat produced per cow. It is assumed that the manure and skim milk credits will offset the cost of housing and equipment charge.

While the primary costs were accurately kept, the production per cow was partially estimated so that the costs per pound of fat may be considered as a fairly accurate estimate. The average cost per pound of butterfat was 1.6 cents lower in 1928 than in 1927. Feed and pasture cost was $6.81 higher. Depreciation, man labor, and other costs were less. Average production of butterfat per animal was 7.9 pounds more. This may be due to better cows in the herd due to selling off the worst or it may be due to better care being accorded the cows since they have been kept in fenced pastures. The average appreciation per animal was 35 cents more in 1928 than in 1927.

TABLE 21—Milk Cows—Annual Quantity Costs per Animal Unit—Arrayed on Cost per Pound of Butter Fat—15 Farms—Jones County, Miss.—1928

Farm Number	Concentrates					Roughage				Man Labor	Horse Work
	Cotton Seed Meal	Cotton Seed	*Corn	Other	Total	Hay	Cotton Seed Hulls	Total	Pasture		
	Pounds	Pounds	Pounds	Pounds	Pounds	Tons	Tons	Tons	Days	Hours	Hrs.
12	266	—	—	—	266	.51	.08	.59	366	19.2	—
4	426	—	130	16	572	.20	.12	.32	298	37.9	—
9	324	—	635	—	959	—	—	—	366	51.9	—
7	366	—	—	—	366	.17	—	.17	366	55.1	—
10	789	—	—	26	815	.04	.53	.57	366	82.8	—
8	478	—	125	174	777	—	.19	.19	366	62.7	2.6
1	620	—	—	—	620	.15	.12	.27	366	79.4	—
6	580	—	—	—	580	.04	—	.04	265	66.7	—
5	67	—	—	—	67	.19	.08	.27	366	50.2	—
2	162	—	295	43	500	.17	.05	.22	366	50.2	—
3	167	—	—	—	167	—	.07	.07	297	38.5	—
11	258	145	—	346	749	—	.01	.01	366	44.9	—
14	749	—	851	506	2106	—	—	—	366	79.4	.8
13	458	—	300	375	1133	.09	.02	.11	366	66.4	—
15	208	357	299	—	864	.07	—	.07	366	46.5	—
Wt. Ave.	355	39	166	92	652	.11	.07	.18	346	51.9	.2

* In ear unhusked—72 pounds equals 1 bushel.

Cows were fed somewhat heavier on the average in 1927 than in 1928, but more advantage of pasture was taken during the latter year. There was an increase in practically all items of cost as compared to 1927.

Of the concentrate feed fed other than cotton seed meal, cotton seed and corn, 54 percent was sweet potatoes, 41 percent was commercially mixed feed, and 5 percent was shorts.

Table 22 will give an idea of the possibilities of a farm flock of poul-

TABLE 22—Poultry—Annual Cost per Head, Cost per Dozen Eggs and Net Profit per Head Arrayed on Net Profit per Head—15 Farms—Jones County, Miss.—1928

Farm Number	Poultry per Farm	Value of Feed	Value of Labor	Cost per Head	Eggs per Head	Cost per Dozen	Value of Eggs	Meat per Head	Value of Meat	Profit per Head
	Number	Dol.	Dol.	Dol.	Doz.	Cents	Dol.	Pounds	Dol.	Dol.
4	110	.84	.25	1.09	4.2	26.0	1.05	7.4	1.66	1.62
2	125	1.62	.35	1.97	10.7	18.4	2.30	4.9	1.28	1.61
12	32	.06	.24	.30	5.2	5.8	1.38	1.6	.28	1.36
5	30	.47	.28	.75	4.7	16.0	1.41	2.3	.43	1.09
11	50	.58	.51	1.09	2.8	38.9	.77	4.1	1.35	1.03
8	125	1.51	.28	1.79	4.5	39.8	1.10	9.0	1.72	1.03
1	60	.44	.15	.59	3.3	17.9	.83	2.5	.78	1.02
3	33	.65	.12	.77	5.2	14.8	1.29	1.9	.39	.91
10	15	.33	.65	.98	8.7	11.3	2.25	-2.3	-.39	.88
13	40	.48	.15	.63	5.6	11.2	1.37	.3	.08	.82
14	60	.48	.11	.59	6.0	9.8	1.31	.1	.02	.74
7	50	.63	.21	.84	6.9	12.2	1.44	.5	.10	.70
6	32	.68	.19	.87	3.3	26.4	.79	3.1	.63	.55
9	48	.19	.14	.33	2.5	13.2	.62	.5	.10	.39
15	20	.50	.20	.70	3.8	18.4	.94	—	—	.24
Wt. Ave.	Per Fm. 55	.85	.25	1.10	5.5	20.1	1.29	3.9	.89	1.08

try. Records of production were not accurately kept so that it was necessary to partially estimate these items. The cost of producing eggs and the profit per head are, therefore, no more than a reasonably good estimate. The cost of producing eggs was obtained by dividing the annual cost per head by the eggs produced. Had the value of poultry meat been deducted from the cost before making this calculation, three of the farms would have had an egg production cost of less than nothing and a number of others would have had practically no cost. Eggs not sold were valued at 25 cents per dozen and unsold meat was valued at 20 cents per pound. No charge was made for interest on investment and it was assumed that the manure credit offset a building charge. The number per farm is shown in the average of the first and last inventories. A number of small items such as eggs for hatching, incubation charges, and baby chicks, amounting together to 23 percent of the labor charge, was included in value of labor.

The average annual cost per head of keeping poultry was considerably more in 1928 than in 1927, the comparative amounts being $1.10 and 70 cents. Higher average production per head was obtained in 1928, being 5.5 dozen eggs and 3.9 pounds of meat as compared to 4.1 dozen eggs and 3.8 pounds of meat obtained in 1927. However, this higher production was not sufficient to offset the higher cost of keep, so that the profit per head for 1928 was below that for 1927, the amounts being $1.08 and $1.12 respectively.

The data shown in table 23 represent actual records. Of grain, 94.4 per cent was unhusked ear corn, 72 pounds per bushel and the remainder oats.

Mill feeds consisted of shorts, scratch, and chick feed. Some skim milk was fed, usually in irregular amounts and at irregular times of which no record was kept.

More feed, both of home grown and purchased feed, was fed per head in 1928 than during the preceding year which accounts for the higher feed cost. Although a little more time per head was devoted to chickens in 1927 than in 1928, the cost of this item appears higher for the latter year because of the inclusion of some miscellaneous items.

TABLE 23—Poultry—Annual Quantity Costs per Head—Arrayed on Net Profit per Head—15 Farms—Jones County, Miss.—1928

Farm Number	Poultry per Farm	Corn and Other Grains	Mill Feeds	Total Grain	Oyster Shells and Grit	Man Labor
	Number	Pounds	Pounds	Pounds	Pounds	Hours
4	110	25.5	15.7	41.2	1.0	.7
2	125	59.8	22.7	82.5	.8	1.5
12	32	4.5	—	4.5	—	1.4
5	30	17.5	5.0	22.5	—	1.9
11	50	18.2	6.5	24.7	—	.7
8	125	37.3	30.0	67.3	—	.9
1	60	22.8	3.3	26.1	—	1.0
3	33	46.9	—	46.9	—	.8
10	15	24.0	—	24.0	—	4.4
13	40	34.2	—	34.2	—	1.0
14	60	32.4	.2	32.6	—	.8
7	50	36.7	4.0	40.7	—	1.2
6	32	38.2	6.2	44.4	—	1.1
9	48	13.5	—	13.5	—	.9
15	20	36.0	—	36.0	—	1.3
	Per Farm					
Wt. Ave.	55	33.2	11.3	44.5	.3	1.1

The recorded data on pork production and costs are shown in table 24.

In discussing this enterprise in the 1927 report, the statement was made that under conditions where hogs must be kept under fence, good management is more essential than under the range system. The results shown by the 1928 records partially bear out the truthfulness of this statement. In 1928 the average quantity of pork produced per farm was less than in 1927. More corn and more other feeds were required per hundred pounds of gain. The value of pasture was nearly double. Only the charge for labor was a little less. As a consequence the average cost per pound of pork produced in 1928 was 3.68 cents greater than the average for 1927 and this in spite of the fact that one farmer lost practically his whole increase with cholera in 1927.

An outstanding factor in the high cost of producing pork in 1928 was the poor quality of hogs kept. Only a few of the cooperators secured improved stock, the remainder retaining the common hogs which had been accustomed to range conditions. These were put under fence, and although

TABLE 24—Pork—Quantity Costs per Hundredweight of Dressed Pork with Values Arrayed on Cost per cwt. of Dressed Pork—15 Farms—Jones County, Miss.—1928

Farm Number	Pork Production per Farm	Feed				Value of Pasture	Man Labor		Other Costs	Cost per cwt.
		*Corn	Other Feed	Total Feed			Amount	Value		
				Amt.	Value					
	Pounds	Pounds	Pounds	Pounds	Dols.	Dols.	Hours	Dols.	Dols.	Dols.
5	1254	252	68	320	4.96	.75	6.5	.98	—	6.69
8	2092	305	259	564	10.17	.70	5.6	.84	—	11.71
2	536	658	—	658	9.14	.91	18.4	2.78	—	12.83
1	633	466	222	688	8.82	1.85	15.1	2.27	—	12.94
3	644	649	93	742	11.35	—	11.3	1.69	—	13.04
6	770	720	39	759	10.94	.89	8.3	1.24	—	13.07
10	195	517	77	594	9.07	—	33.6	5.05	—	14.12
7	240	1020	—	1020	14.16	—	15.7	2.35	—	16.51
9	528	1159	—	1159	16.09	3.23	13.6	2.04	—	21.36
4	373	1110	94	1204	17.73	—	25.4	3.82	—	21.55
13	335	1096	60	1156	16.70	2.71	26.7	4.00	—	23.41
14	723	973	912	1885	22.83	1.90	12.7	1.90	1.19	27.82
15	83	2212	—	2212	30.72	—	31.5	4.72	—	35.44
11	87	1366	276	1642	21.27	12.59	67.4	10.10	—	43.96
12	219	1216	2527	3743	38.88	—	43.2	6.48	—	45.36
Wt. Ave.	581	641	249	890	12.51	1.13	13.3	1.99	.10	15.73

* In ear unhusked—72 pounds equal 1 bushel.

TABLE 25—Value of Items Furnished the Home and Value of Family Labor 15 Farms—Jones County, Miss.—1928

Farm Number	Livestock and Livestock Products	Crops and Garden	Use of Residence	Use of Auto	Man Labor	Horse Work	Total	Value of Family Labor*	Excess Furnished Home	Excess Furnished Farm
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1	113.88	60.98	70.50	53.58	3.30	1.79	304.03	12 65	291 38	—
2	274 28	102 06	73.90	62.38	18.22	2.82	533.66	9.60	524.06	—
3	111.04	36.36	52 38	14 48	12.00	4.80	231.06	35.02	196.04	—
4	135.51	11.92	115.75	21.03	27.30	6.63	318.14	118.95	199.19	—
5	238.86	42 92	128.50	72.28	29.10	12.53	524.19	64 35	459 84	—
6	192.58	137.95	88.25	105.94	7.35	1.49	533.56	134.70	398.86	—
7	206.39	65.39	17.57	43.64	18.90	1 71	353.60	98 25	255 35	—
8	141.09	60.19	104.25	78 26	12.00	5 29	401.08	—	401.08	—
9	168.25	74.88	190.06	112.39	4.50	2.82	552.90	12.00	540.90	—
10	223.58	61.50	57.70	44.96	9.00	5 02	401.76	239 15	162.61	—
11	186.20	59.83	59.38	—	1.65	.98	308.04	73.80	234.24	—
12	113.34	113.83	34.90	—	3.75	—	265.82	—	265.82	—
13	183.53	86.57	86.25	10.34	9.90	1.61	378.20	—	378.20	—
14	234.60	84.05	53.10	—	61.50	25.23	458.48	378.22	80.26	—
15	136.83	26.22	33.70	—	.90	—	197.65	255.15	—	57.50
Average per farm	177.33	68.31	77.75	41.28	14.62	4.85	384.14	95.45	292.52	3.83

* Includes board to labor.

a number of farmers grazed them on sweet potatoes or on corn, gains were slow and the enterprise was unprofitable. Many of the hogs appeared to be infested with worms, in addition to being of very poor stock. The necessity for better management of this enterprise is strongly emphasized.

In the column headed "other feeds", 80.8 percent was sweet potatoes, 18.4 percent was shorts, and the remaining .8 percent was oats, rice polish and pig meal. Some skim milk was also fed of which no record was kept.

The value of items furnished the home and the value of family labor at 15 cents per hour are shown in table 25. This table differs slightly from the corresponding table in the 1927 report in that the value of wood was shown in 1927. Since the value of wood represents the labor and horse work required to deliver it in suitable form to the home, this item is included in the "man labor" and "horse work" columns.

Although all items furnished the home except man labor and horse work were larger in 1927 than in 1928, the value of family labor was so much less for the latter year that when this item was deducted from the total value of items furnished the home, the remainder, or excess furnished the home in 1928, was slightly above that for 1927.

The automobile and truck accounts are shown in table 26. It is included

TABLE 26—Auto and Truck Accounts—Automobiles—10 Farms—Jones County, Miss.—1928

Farm Number	Man Labor	Gas and Oil	Building Charge	License, Interest and Taxes	Depreciation	Repairs	Gross Cost	Credits*	Net Cost	Net Profit
	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.
1	—	16.00	.80	17.50	—	55.00	89 30	53.58	35.72	—
2	—	39.14	—	26.00	50.00	40.81	155.95	62.38	93.57	—
***3	5.55	35.08	—	33.25	75.00	77.00	225.88	167.98	57.90	—
4	6 00	144.80	—	23.25	75.00	89.51	338.56	149.28	189.28	—
5	—	76.80	—	34.75	25.00	8.00	144.55	72.28	72.27	—
6	—	48.66	—	22.00	50.00	20.60	141.26	105.94	35.32	—
7	.75	22.28	—	14.90	20.00	.25	58 18	43.64	14.54	—
8	—	68.19	.50	26.75	60.00	—	155.44	103.26/	52.18	—
9	—	29.15	—	26.00	50.00	49.70	154.85	117.39	37.46	—
10	—	28 32	4.42	17.20	10.00	—	59.94	44.96	14.98	—
				Average per Auto						
	1.23	50.84	.57	24.16	41.50	34.09	152.39	92.07	60.32	—
				Trucks—3 Farms						
12	—	70.32	—	22.00	50.00	6.55	148.87	—	148.87	—
13	—	45.88	—	28.25	—	157.60	231.73	35.34**	196.39	—
15	—	29.20	—	18.75	25.00	—	72.95	—	72.95	—
				Average per Truck						
	—	48.46	—	23.00	25.00	54.72	151.18	11.78	139.40	—

* Household use and income from hire.

** Appreciation of $25.00 included.

*** Truck after September.

/ $25.00 received for old tires included.

merely to indicate the approximate cost of operating these conveyances. No record of mileage was kept and this was a variable figure as indicated by the gasoline and oil expense. Aside from the satisfaction derived from an automobile, their profitableness on the farm lies in saving time and using them for carrying products to market and supplies to the farm. Trucks may have an additional factor for profit in their possibilities for commercial use.

TABLE 27—Distribution of Farm Area—15 Farms—Jones County, Miss.—1928

Farm Number	All Permanent Pasture	Waste and Other	Owner's Crops				Cropper's Crops				Total Farm Area
			Cotton	Corn	Other**	Total	Cotton	Corn	Others**	Total	
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
1	16.71	123.42	10.14	5.80	4.27	20.21	—	—	—	—	160.34
2	51.39	28.99	12.30	10.95	16.37	39.62*	—	—	—	—	120.00
3	21.07	20.53	7.98	9.05	1.30	18.33	15.19	3.49	1.39	20.07	80.00
4	32.23	51.67	13.21	5.51	12.11	30.83	18.35	6.01	.91	25.27	140.00
5	21.51	6.10	10.15	4.42	12.79	27.36	—	—	—	—	54.97
6	4.09	117.65	12.18	13.38	4.30	29.86	71.11	19.39	2.70	93.20	244.80
7	15.70	114.60	8.82	6.81	.46	16.09	11.18	1.67	.76	13.61	160.00
8	67.48	22.84	8.68	8.60	5.68	22.96	—	—	—	—	113.28
9	14.62	52.46	8.70	6.66	11.22	26.58	28.10	15.17	1.07	44.34	138.00
10	11.31	3.31	11.67	3.30	1.63	16.60	—	—	—	—	31.22
11	14.10	7.02	8.58	6.12	4.18	18.88	—	—	—	—	40.00
12	39.44	89.95	8.79	5.33	5.61	19.73	9.54	1.34	—	10.88	160.00
13	54.80	9.20	5.50	2.30	1.50	9.30	45.50	1.60	.10	47.20	120.50
14	32.14	2.10	13.67	9.99	2.10	25.76	—	—	—	—	60.00
15	4.39	7.73	20.53	7.05	.60	28.18	—	—	—	—	40.30
Ave.	26.73	43.83	10.73	7.02	5.61	23.36	13.27	3.24	.46	16.97	110.89

** Includes garden.

* .73 acres double cropped.

The percentage of different kinds of land which make up the farm may have considerable influence on the net income from the farm. Table 27 shows the distribution of the farm area on the cooperating farms. The average, converted to a percentage basis, shows, permanent pasture, 24.1 percent; waste and other land, 39.5 percent; owner's crops, 21.1 percent, and cropper's crops, 15.3 percent.

No doubt when this land was acquired, it was the intention to improve all potentially cultivatable land or it was expected that the land would increase in value and the purchase was looked upon as a temporary investment. In either case, the taxes assessed against the waste land, which includes the farmstead, must be borne by the productive parts of the farm. The uses to which uncultivatable or waste land may be put are few, but any possible use which would not require too great an outlay would at least reduce the cost of carrying such land. Such land can be made into excellent pasture by cutting weeds and bushes and introducing desirable pasture plants if sufficient livestock are kept to require its use. As a

last resort, one may guard the tract against fire and trespass, and the growth of timber will ordinarily be sufficient to pay the taxes over a period of from ten to 50 years.

TABLE 28—Sources of Farm Labor**—15 Farms—Jones County, Miss.—1928

Farm Number	Total Farm Area	Owner Crops	Cropper Crops	Total Livestock	Labor					
					Proprietor	Family	Paid	Exchange	Gratis	Total
	Acres	Acres	Acres	A. U.	Hours	Hours	Hours	Hours	Hours	Hours
1	160.34	20.21	—	4.98	2352	51	409	65	—	2877
2	120.00	39.62*	—	6.89	2704	84	444	100	—	3332
3	80.00	18.33	20.07	7.89	2058	234	238	71	—	2601
4	140.00	30.83	25.27	10.03	2223	393	1457	57	—	4130
5	54.97	27.36	—	9.74	2298	429	272	43	30	3072
6	244.80	29.86	93.20	9.55	1779	922	30	33	—	2764
7	160.00	16.09	13.61	5.55	1944	655	59	143	—	2801
8	113.28	22.96	—	10.86	2478	—	10	—	—	2488
9	138.00	26.58	44.34	9.96	2052	80	875	75	—	3082
10	31.22	16.60	—	4.20	2105	1594	198	—	—	3897
11	40.00	18.88	—	9.97	1875	492	—	—	—	2367
12	160.00	19.73	10.88	5.72	1828	—	807	71	—	2706
13	120.50	9.30	47.20	8.92	1289	—	180	13	—	1482
14	60.00	25.76	—	6.69	2553	2522	3	8	18	5104
15	40.30	28.18	—	5.76	1708	1701	—	—	—	3409
Ave.	110.89	23.36	16.97	7.78	2083	611	332	45	3	3074

** Exclusive of labor on cropper crops.

* .73 acres double cropped.

Table 28 shows the sources of the labor done on the farm with the exception of that performed on the cropper's crops which, of course, was done by the cropper and his family.

It will be noted that the proprietor performed most of the farm work on the cooperating farms. Next to the proprietor, his family is the greatest contributor, with paid labor, exchange labor and gratis labor following in order. The exchange of work was usually made with a cropper on the farm, but in a number of instances neighbors exchanged labor on such operations as hay harvest. Exchange of labor among neighbors is ordinarily an agreeable and profitable practice because on the farm time is quite often more plentiful than money with which to hire labor. Gratis labor was not performed in a spirit of charity, but was performed by neighbors who perhaps assisted in covering a building or clearing a plot of ground and paid a friendly call at the same time.

The distribution of man labor on the several farms is shown in table 29. An average of 233 hours or about 7.6 percent of the total labor performed was done off the farm. In an undeveloped farming community, outside labor is a common method of adding to the family income. As development proceeds, however, opportunities for outside work ordinarily become less and the farmer must look more and more to his own resource-

TABLE 29—Distribution of Total Man Labor on the Farm*—15 Farms—Jones County, Miss.—1928

Farm Number	Total Farm Area	Owner's Crops	Cropper's Crops*	Total Livestock	Real Estate Maintenance	Equipment Maintenance	Household	General	Labor Off Farm	Livestock				Crops				Total of All Labor	Total Labor on Farm**
										Workstock	Cattle	Hogs	Poultry	Cotton	Corn	Hay	Other Crops		
	Acres	Acres	Acres	A. U.	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours
1	160.34	20.21	—	4.98	305	—	22	12	940	91	129	96	59	619	315	118	171	2877	1937
2	120.00	/39.62	—	6.89	334	2	122	24	190	144	147	98	190	697	291	846	247	3332	3142
3	80.00	18.33	20.07	7.89	384	37	80	13	244	149	131	72	26	853	306	101	205	2601	2357
4	140.00	30.83	25.27	10.03	338	80	182	661	119	168	232	95	80	1197	346	294	338	4130	4011
5	54.97	27.36	—	9.74	164	—	194	48	108	224	232	82	56	832	229	209	694	3072	2964
6	244.80	29.86	93.20	9.55	329	9	49	36	33	268	184	64	36	968	464	154	170	2764	2731
7	160.00	16.09	13.61	5.55	420	13	126	60	118	121	158	38	59	1193	411	5	79	2801	2683
8	113.28	22.96	—	10.86	435	4	80	21	35	153	***154	117	108	689	378	51	263	2488	2453
9	138.00	26.58	44.34	9.96	603	2	30	—	340	209	176	72	46	934	389	231	50	3082	2742
10	31.22	16.60	—	4.20	196	24	60	226	52	159	158	66	65	2334	344	18	195	3897	3845
11	40.00	18.88	—	9.97	174	—	11	—	360	70	206	58	33	991	294	—	170	2367	2007
12	160.00	19.73	10.88	5.72	463	20	25	263	134	183	50	95	46	762	243	129	293	2706	2572
13	120.50	9.30	47.20	8.92	355	14	66	9	90	194	159	89	40	393	46	20	7	1482	1392
14	60.00	25.76	—	6.69	726	45	410	110	154	101	168	92	46	1905	646	42	659	5104	4950
15	40.30	28.18	—	5.76	165	—	6	—	585	157	157	26	26	2024	249	—	14	3409	2824
Ave.	110.89	23.36	16.97	7.78	359	17	98	99	233	159	163	77	61	1093	330	148	237	3074	2841

* Man labor on cropper's crops not included.

** Total of all labor less labor off the farm.

*** Includes 10 hours for sheep.

/ .73 acres double cropped.

TABLE 30—Distribution of Total Horse Work on the Farm—15 Farms—Jones County, Miss.—1928

Farm Number	Total Farm Area	Owner's Crops	Cropper's Crops	Total Livestock	Real Estate Maintenance	Equipment Maintenance	Household	General	Work Off Farm	Livestock			Crops					Total of All Work	Total Work on Farm*
										Work Stock	Cattle	Hogs	Cotton	Corn	Hay	Cropper's Crops	Other Crops		
	Acres	Acres	Acres	A. U.	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours
1	160.34	20.21	—	4.98	177	—	16	—	48	—	—	—	378	376	195	—	188	1378	1330
2	120.00	39.62**	—	6.89	142	—	32	22	210	16	—	—	527	352	957	—	191	2449	2239
3	80.00	18.33	20.07	7.89	276	—	48	18	79	—	—	—	574	328	128	1180	78	2709	2630
4	140.00	30.83	25.27	10.03	105	—	62	37	182	—	12	—	461	362	254	—	180	1655	1473
5	54.97	27.36	—	9.74	102	—	116	—	96	—	—	—	482	290	281	—	545	1912	1816
6	244.80	29.86	93.20	9.55	121	—	10	16	21	—	—	—	455	409	130	3085	104	4351	4330
7	160.00	16.09	13.61	5.55	71	—	16	—	65	—	—	—	489	381	10	695	52	1779	1714
8	113.28	22.96	—	10.86	62	—	46	16	—	8	6	—	538	477	102	—	231	1486	1486
9	138.00	26.58	44.34	9.96	218	—	20	—	60	—	—	—	474	319	277	1554	45	2967	2907
10	31.22	16.60	—	4.20	82	—	44	61	52	—	—	—	779	287	24	—	158	1487	1435
11	40.00	18.88	—	9.97	10	—	11	—	—	—	—	—	456	220	—	—	129	826	826
12	160.00	19.73	10.88	5.72	44	—	—	—	20	—	—	—	337	223	93	387	85	1189	1169
13	120.50	9.30	47.20	8.92	14	—	10	4	70	—	—	—	156	53	30	1328	9	1674	1604
14	60.00	25.76	—	6.69	91	2	304	44	65	—	—	10	670	458	36	—	205	1885	1820
15	40.30	28.18	—	5.76	110	—	—	—	—	—	—	—	796	252	—	—	10	1168	1168
Ave.	110.89	23.36	16.97	7.78	109	—	49	15	65	—	—	—	505	319	168	549	148	1927	1862

* Total of all work off the farm.

** .73 acres double cropped.

fulness to supply himself with steady employment. The practice of securing outside work when none is provided on the farm cannot be criticized, but farm work should not be neglected for outside employment since timeliness in the performance of many farming operations is of great importance. The good farm manager tries to utilize all of his available labor profitably on the farm.

In order to provide constant employment on the farm, enterprises which have their peak labor requirements falling in the winter are desirable. Livestock, and especially dairy cows, constitute such an enterprise. Hogs and chickens also provide considerable winter employment, but were these enterprises developed to a size sufficient to provide steady full time employment in winter, the hazards of production and marketing might be disproportionatly great. However, one or both of these enterprises fits in well with dairying. The average time per farm devoted to cattle constituted 5.3 percent of the total labor performed, and cattle, hogs and poultry, taken together, consumed 9.8 percent of the total labor supply. With careful management, more labor might profitably be expended on these enterprises.

Table 30 shows the distribution of horse work for the several farms. Since the cost of horse work is largely influenced by the amount of work done, the good manager provides as much productive work for his work animals as possible. Real estate maintenance required an average of 109 hours per farm or over 5.6 percent of all work done. Cleaning ditches, repairing and constructing terraces and clearing new land furnish opportunities for profitable employment of workstock in the winter. Work off the

TABLE 31—Household and Personal Expenses (as reported)
15 Farms—Jones County, Miss.—1928

Farm Number	Groceries	Household	Personal	Dry Goods	Total
	Dols.	Dols.	Dols.	Dols.	Dols.
1	33.00	—	26.50	19.87	79.37
2	141.10	73.83	54.68	—	269.61
3	63.17	1.35	153.65	—	218.17
4	96.01	—	311.16	—	407.17
5	225.02	18.00	77.70	14.00	334.72
6	142.37	6.20	108.83	148.39	405.79
7	66.45	9.30	37.95	71.90	185.60
8	109.60	8.00	3.00	57.50	178.10
9	201.43	25.00	128.82	7.58	362.83
10	128.05	4.40	24.78	79.88	237.11
11	109.50	19.49	64.02	—	193.01
12	154.53	10.00	13.16	76.83	254.52
13	90.62	11.75	41.02	—	143.39
14	114.48	10.65	141.00	44.37	310.50
15	250.91	37.50	—	46.35	334.76
Average	128.42	15.69	79.08	37.78	260.97

farm constituted nearly 3.4 percent of the average total work done. The cost of maintaining idle workstock should be considered in deciding whether to take outside employment or use available labor at home on livestock enterprises which make small demands on available horse work. Family labor is often able to care for livestock enterprises without seriously interfering with school duties of children which makes it possible for the proprietor to use his workstock in outside employment. Where employment for workstock cannot be provided, the grain feed allowance may be materially reduced where good quality hay is used.

While the household and personal expenses have nothing to do with the farm business since they would necessarily be incurred regardless of the business in which one engaged, they are shown in table 31 for the interest which may be found in them. The sum of these expenses and the expense of operating the farm deducted from the total farm receipts will show what remains for investment or surplus.

The column headed "groceries" includes kerosene and gasoline for lights and cooking. The household column is made up of expenses for furniture and household equipment. Under "personal" is listed such items as doctor bills, medicine, school books, pleasure trips, tobacco, and some clothing. Where clothing and dry goods were so designated in the reports it was placed in the dry goods column.

The discussion in this report has been confined largely to comparisons of data secured in 1928 with those secured in 1927 and with state and United States averages. It is again suggested that the discussion contained in the 1927 report, Bulletin 256 of this station, be read in connection with this report.

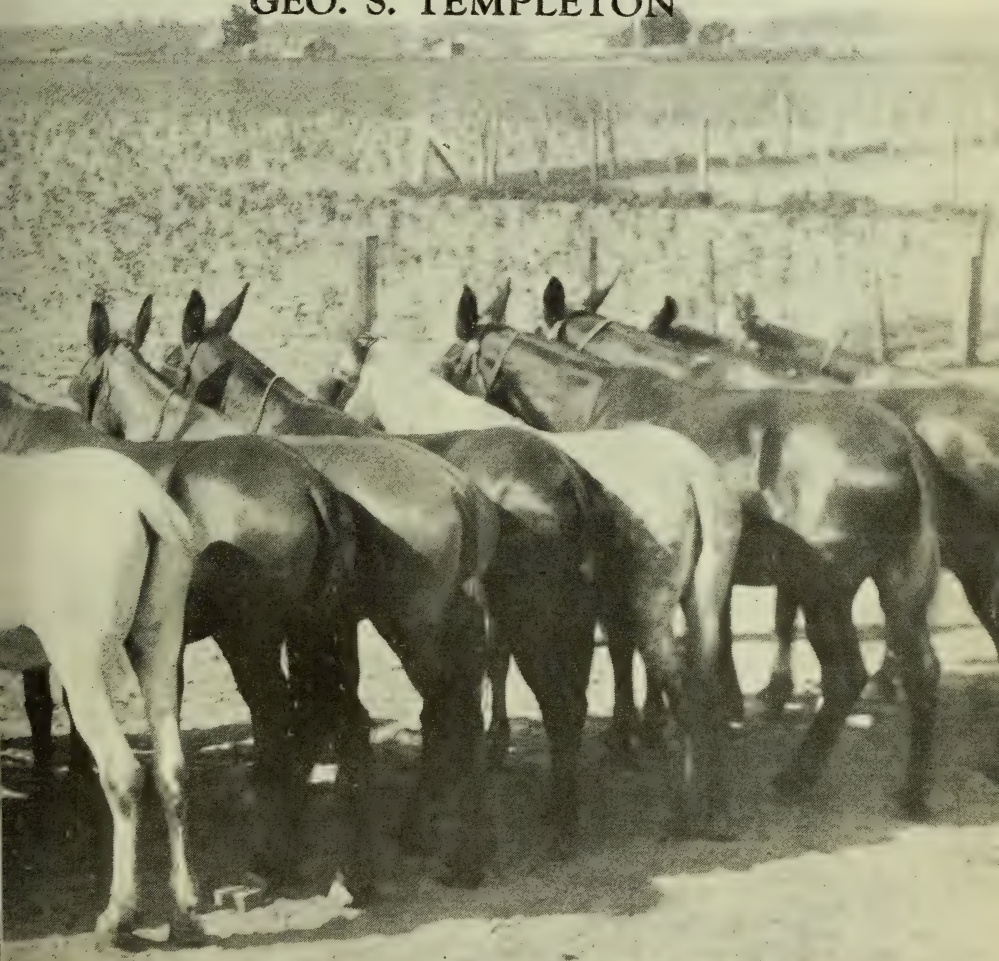
BULLETIN NO. 270 AUGUST 1929

MULE FEEDING EXPERIMENTS

Part I—Self-Feeders for Work Mules
Part II—Grinding Shelled Corn and Ear Corn for Work Mules
Part III—Johnson Grass Hay versus Soybean Hay
Part IV—Stall versus Lot Feeding
Part V—Salt Requirements of Work Mules

By

GEO. S. TEMPLETON



Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
J. R. Ricks, Director

SUMMARY

The self-feeder has proved to be an excellent system for feeding large groups of farm work mules.

The use of the self-feeder for plantation mules makes it possible to fatten and carry in high condition mules doing heavy work.

The self feeder eliminates the waste of feed by preventing weather damage and losses due to birds and rodents. The mules waste very little feed in feeding from the self-feeder.

Old mules with good teeth that under the lot system of feeding were considered past their period of usefulness were brought back to a satisfactory condition of flesh and rendered good service when self-fed.

The self-feeder system was practically free from the ordinary errors made in feeding by the average negro lot boy.

The grain consumption per 1000 pounds live weight daily has averaged from 13.4 pounds of shelled corn to 13.7 pounds. These amounts are in line with the amount of concentrates consumed by mules under the lot feeding system.

The self-feeder system has practically eliminated the "boss" mule; consequently the old, weak, and timid mules have equal opportunity for feeding and the lot of mules so fed maintained a satisfactory and uniform condition of flesh.

Self-feeders with large storage capacity economize very materially on the amount of labor required to feed mules.

From the very small number of digestive troubles that have developed during the two years of the experiments, it was very evident that there was considerably less trouble from digestive disorders with mules being self fed than usually occurs where mules are lot fed.

Grinding shelled corn for mules at hard work resulted in a saving of about 10 per cent. Ninety pounds of shelled corn ground was equal in feeding value to 100 pounds of shelled corn when the teeth of the mules were kept in good condition.

Grinding ear corn (without the shuck) for mules at hard work resulted in a saving of about 10 per cent. Ninety pounds of ear corn ground was equal in feeding value to 109 pounds of ear corn where the teeth of the mules were kept in good condition.

On the basis of the experiment reported in this bulletin, 12 pounds of Johnson grass hay was the equivalent of 11 pounds of soybean hay.

With the prevailing prices of 87 cents per bushel for corn and $12.00 a ton for Johnson grass hay, the soybean hay was worth $13.09 per ton.

There was no noticeable difference in either the stall or lot fed mules in their health, spirit, ability to work, or stand the heat.

The lot fed mules, fed ad libitum, consumed on an average for the six experimental periods 15.15 pounds of ear corn and 11.29 pounds of Johnson grass hay per 1000 pounds live weight per day.

The stall fed mules were fed a ration of 13.7 pounds of ear corn and 12 pounds of Johnson grass hay per 1000 pounds live weight per day.

On the basis of this experiment, it cost $82.12 a year to maintain a mature 1000 pound mule doing heavy work when stall fed and $97.60 for a 1000 pound mule that was lot fed.

On the average, the experimental mules consumed 4/10 of an ounce of salt per 1000 pounds live weight daily. During the spring and summer, the consumption ran as high as 46/100 of an ounce. This quantity decreased during the fall and winter season to an average of 3/10 of an ounce daily.

The rations reported in this bulletin are on the basis of a 1000 pound mule per day. In adapting these rations to mules of other weights, the feed can be figured on the percentage basis. An 800 pound mule would receive 20 per cent less feed, and a 1200 pound mule would receive 20 per cent more feed than indicated for a 1000 pound mule.

PART I

SELF-FEEDERS FOR WORK MULES

On the plantations and larger farms in the state where large numbers of mules are maintained, the general practice is to feed the mules in groups or lots. In lot feeding mules during the busy season, enough grain and enough hay are placed in the trough and in the feed racks each day so the mules will have free access to the grain and the hay at all times. Usually during the wintering period when the mules are idle, grain feeding is discontinued and the hay racks are kept full of roughage. The feeding habits of mules make this system very practical and the approval of this style of feeding is evidenced by the fact that a very large number of plantation owners and managers use the system.

The fact that there is considerable grain lost when large numbers of mules are fed from troughs is demonstrated by the presence of feeder hogs in the mule lots. When the feed troughs are out in the lot, as is quite often the case, the feed is damaged by the weather and there is considerable loss due to bird waste.

Unless the trough space per mule is ample the more timid, weaker, and older mules fail to get their portion of the feed and suffer accordingly. This fact is borne out by the lack of flesh of the more timid, weaker, and older mules in the lots as compared with the "boss" mules that are usually carrying considerable condition.

The dependability of the negro lot boy is a variable factor and so is the Saturday evening and Sunday feed supply for the mules that are under his care.

Self-feeders have been used very successfully in the feeding of hogs for a number of years. The self-feeder when used with this type of animal has eliminated considerable waste that was experienced in the hand feeding of hogs. The self-feeders are so constructed that there is practically no weather damage of the feed and no loss due to birds. When the hogs become accustomed to using the self-feeder, they eat small quantities of feed at a time and come back to the feeder at short intervals. This type of feeding has done away with crowding at feeding time and the hogs in the lot take on condition uniformly when fed under this system.

The Animal Husbandry Division of the Mississippi Experiment Station has been making numerous studies of mule feeding problems for several years. As it was impossible to have a large enough number of mules on the Experiment Station to make a test of this type of feeding mules, arrangements were made with Mr. D. Howard Doane, of the Doane Agricultural Service of St. Louis, Missouri, general managers of the plantation, to conduct a cooperative experiment on the plantation of the Robertshaw Company at Heathman, Mississippi. Mr. Doane drew plans for a small self-feeder to be used in the preliminary tests. Mr. W. J. Godbold, resident manager of the Robertshaw plantation, agreed to furnish the mules, feed, and equipment for the test. A trained man, Mr. R. H. Means, was to have personal charge of the feeding operations, keeping of records, etc., for the experiment.

OBJECTS OF THE EXPERIMENT

The objects of the experiment were as follows:

1. To perfect a self-feeder that would be adapted to the use of mules.

2. To compare the system of self-feeding mules with that of lot feeding mules.

3. To determine by experimentation ration combinations that could be used in a self-feeder at different seasons of the year and meet the body requirements of mules doing varying kinds of farm work, and eliminate as far as possible the human element in the feeding operations.

PLAN OF THE INVESTIGATION

The plan of the experiment was to divide 10 pairs of mules into two lots in such a manner as to place team mates in Lot I and Lot II. The rations for the two lots were as follows:

Lot I—Self fed mules—A mixture of two parts ground shelled corn and one part ground alfalfa hay in self feeder. Additional alfalfa hay in a convenient rack.

Lot II—Lot fed mules—Shelled corn in a trough and alfalfa hay in a convenient rack.

The mules were used during the experimental period to perform the regular farm work on the plantation. Practically all of the mules were doing the same type of work at the same period. The experiment was started on March 20 and continued until July 24, a total of 126 days.

MULES USED

The different teams selected for the test varied considerably. Some of the teams were young and in good condition. Others were of good age but thin, and some of them were old and lacking in condition. However, the lots were comparable, for the team mates in the two lots balanced each other as to age, quality, condition, and weight.

FEEDS USED

The shelled corn used in the test varied in quality from a number two mixed corn to a number three yellow corn. This grain was purchased on the market. Small amounts of ear corn were fed for a few days to Lot II. This feed was fed to the mules on a shelled corn basis and so reported in the table. Leafy brown alfalfa hay was used in both lots until June 5 when the new crop of pea green alfalfa hay was available. The better quality of hay was used for the remainder of the feeding period. The variations in the quality of corn and hay do not enter into the experiment, for in all cases a given kind of feed was fed to both lots at the same time.

FEEDING AND MANAGEMENT

The feed lots used for both groups of mules contained about the same area. Lot I, the self-fed lot, had free access to one side of a small barn. Alfalfa hay was available to these mules in racks under this shelter. A weather proof self-feeder, eight feet long and six feet wide, was placed out in the lot for feeding the corn-hay mixture.

Twelve small doors in the self-feeder furnished sufficient trough space for the 10 head of mules in this lot.

The mules in Lot II had access to half of the same barn that was used for the mules in Lot I. A sixty foot trough under shelter was used for feeding the corn, and a rack of the same length was used for supplying the alfalfa hay. At the beginning of the test, the mixture was replenished in the self-feeder each day. After the test was under way, the capacity of the feeder made it possible to supply enough feed at one time to last for three days. The corn was fed to the mules in Lot II twice each day. About one-fifth of the corn was fed at noon and the balance in the evening.

All of the hay for the two lots was supplied at the evening feed and enough put out each time to last for a 24 hour period. A cover was provided for the feed trough in Lot II and on idle days the lid was lowered and the noon feed omitted. Salt was kept in both lots before the mules at all times, and a deep well furnished a dependable supply of water for both lots. On idle days all the mules were turned on pasture. At the beginning of the experimental feeding period, half of the doors of the self-feeder were propped open for the first day so that the mules would become acquainted with the feeder. The second day all of the doors were allowed to remain closed and the mules opened them of their own accord and gave no further trouble.

RECORDS

Accurate weights of all feeds offered and refused were kept during the experiment. The initial and final weights of the mules consisted of an average of three weights taken on consecutive days. Individual weights of the mules were taken at weekly intervals. Records were kept of the number of days each mule worked, of the health of the mules, and of any unusual circumstances which occurred during the experiment.

PRINCIPLES THAT SHOULD BE INCORPORATED IN A SELF-FEEDER

1. The walls for the hopper should be sloping to facilitate the free movement of the feed into the trough.

2. The throat at the bottom of the hopper should be adjustable so that the flow of the feed being used can be so regulated as to have the concentrate readily available, but not accumulated in quantities sufficient to become fouled by the mules feeding from the self-feeder.

3. The doors in the side of the self-feeder through which the mules eat should be hinged in such a manner as to make the doors easy to open. When the mule is not feeding, the door remains closed to shut out the weather, birds, and rodents.

4. The trough in the bottom of the self-feeder and the trough outside the door should be of sufficient width to allow the mule to have plenty of head room to secure his grain and prevent the loss of grain that usually occurs while the mule is masticating his feed.

5. The capacity of the hopper should be sufficient to provide feed for a given number of mules for a definite number of days.

RESULTS OF THE EXPERIMENT

The Self-Feeder. Changes were made from time to time in the original small self-feeder until the mechanical difficulties were overcome. The self-feeder illustrated in the figure below was constructed at the close of the first season's feeding trials.

Figure 1—Mules using a self-feeder.

This self-feeder is 22 feet and 8 inches long, 8 feet wide, and 8 feet deep, giving a capacity to the hopper of about 1000 bushels of shelled corn. Thirty doors, 16 inches wide and 2 feet high, accommodated 48 head of mules.

Self Feeding versus Lot Feeding of Mules. The following table summarizes the details of the data for the comparison of the two systems of feeding:

Table 1—Summary of Data on Self Feeding versus Lot Feeding of Work Mules
March 20 to July 24, 1928 (126 Days)

	Lot I Self Fed	Lot II Lot Fed
Ration	2 parts shelled corn ground 1 part ground alfalfa hay Mixed in self-feeder Alfalfa hay in rack	Shelled corn in trough Alfalfa hay in rack
Number of mules	10	10
Average initial weight (lbs.)	1071.	1036.
Average final weight (lbs.)	1192.	1160.
Gain in weight (lbs.)	121.	124.
Average weight of mules for test period (lbs.)	1156.	1106.
Total mule days worked	608.25	613.25
Average number days worked per mule	60.8	61.3
Average daily ration per mule		
Shelled corn (lbs.)	14.5	15.3
Alfalfa hay (lbs.)	13.8	11.2
Average daily ration per 1000 pounds live weight		
Shelled corn (lbs.)	12.54	13.83
Alfalfa hay (lbs.)	11.93	10.12
Cost of ration per day per 1000 pounds live weight	34.3c	34.8c

Cost of Feeds

Corn	$1.00 per bushel
Alfalfa hay	20.00 per ton

By referring to the above table, it will be noted that there was very little difference in the amount of increase in live weight of the mules under the different systems of feeding. Both lots made very satisfactory gains. The difference in the amount of work done by the two lots during the experimental period was small enough to be insignificant.

The average daily ration per 1000 pounds live weight for the self-fed mules was 12.54 pounds of shelled corn and 11.93 pounds of alfalfa hay. The lot fed mules consumed 13.83 pounds of shelled corn and 10.12 pounds of alfalfa hay per 1000 pounds live weight daily. On the eleventh of June, it was decided that the grinding of the shelled corn was unnecessary and for the remainder of the feeding test the shelled corn was placed in the self-feeder and the self fed mules had access to alfalfa hay in the hay rack.

By comparing the two rations, it will be noted that the self fed mules consumed a larger proportion of hay to corn than the lot fed mules. No doubt the heavier consumption of alfalfa hay by the self

fed mules is due to the fact that a portion of their hay was ground and mixed with the corn and they were forced to eat more of the roughage because of the mixture being used in the self-feeder.

The grinding of the feed was done on the plantation at odd times and it was impractical to get an accurate figure for the cost of grinding the corn and the hay. In the above table, no account was taken of the cost of grinding the feeds. It was considered that the grinding of the feed was unnecessary and only added to the expense of the ration fed Lot I.

Experimental Ration Combinations for the Self-Feeder. As noted above after observing the self fed mules for two and one-half months, it was decided that there was no apparent advantage in mixing the concentrates and roughage for use in the self-feeder. There was not a single case of digestive disorder in the self fed group of mules. The expense of grinding the feed added materially to the cost of the self fed ration, so on the eleventh of June the original plan of the experiment, which was to work out different combinations of roughage and concentrates to be used in the ration at the different seasons of the year when the mules were doing heavy, medium, or light work, was given up. From this date on for the rest of the experimental period, it was planned to place only the concentrate feed in the self-feeder and the mules would receive the roughage portion of their ration from the hay rack. Further studies were to be made as to the practical application of the self-feeder for use on the plantation.

Maintenance of Health of Mules. There was not a single case of digestive disorder in the self fed or lot fed group of mules for the 126 days that the test was conducted. There were several cases of swamp fever in both lots of mules, but the cases were about evenly divided in Lots I and II.

THE ADAPTABILITY OF THE SELF-FEEDER TO USE ON THE PLANTATION

For a period of 126 days, 10 mules self fed did not show any symptoms of digestive troubles. During this period of time the mules were on full feed and doing heavy work. On idle days they were turned on pasture. After the crops are laid by, only a small per cent of the mules would be necessary to carry on the farming operations on the plantation. These mules could be self fed and the mules not working could be turned on pasture or maintained during the wintering period on roughage without grain. If the self-feeder could be used on a plantation for maintaining only the mules that were doing heavy work or for conditioning mules that lacked flesh, it would have a much wider range of usefulness. Then, too, if during the seasons when mules were doing little work they were turned on pasture and self fed for short periods of time when they were worked, the self-feeder plan would be useful.

It was considered advisable to make a severe test of the self-feeder and determine whether or not abrupt changes, as indicated above, could be made without throwing the mules off feed and causing digestive troubles, so it was decided to conduct a test of this kind for a period of 30 days. Ten head of mules that were thin in condition were se-

lected for this test and placed in the self-feeder lot. Changes were made from time to time, removing the mules from the lot, placing them on pasture without feed, returning them to the self-feeder lot, and making the changes of feed and the amount of work just as drastic as possible. There was not a single case during this month's trial that would indicate that the sudden change to the self-feeder or on to pasture or stalk field caused any digestive troubles.

CONCLUSIONS

1. The use of the self-feeder for plantation mules makes it possible to fatten and carry in high condition mules doing heavy work.

2. The self-feeder eliminates the waste of feed by preventing weather damage and losses due to birds and rodents. The mules waste very little feed in feeding from the self-feeder.

3. The mules soon become accustomed to the self-feeder and this type of feeding nullifies the effect of the "boss" mule, giving all the mules in the lot an equal opportunity for their share of the feed.

4. Old mules with good teeth that under the lot system of feeding were considered past their period of usefulness were brought back to a satisfactory condition of flesh and rendered good service when self fed.

5. Considerably less time was required to feed the mules in the self fed lot than was the case of the lot fed mules.

6. The self-feeder system was practically free from the ordinary errors made in feeding by the average negro lot boy.

7. There was apparently no advantage in grinding the feeds to be used in the self-feeder.

8. The use of the self-feeder fits well into the plantation feeding practices. This system of feeding in no way prevents the use of pastures, rough feeds, stalk fields, etc.

SECOND YEAR TEST WITH SELF-FEEDER

The results from the first year's experiment with the self-feeder were very satisfactory in every way. The mechanical construction was adjusted from time to time until the waste in feeding was practically eliminated. The mules took readily to this type of feeding and the cost of maintaining the mules at the period of the year when they were doing heavy work was in line with the cost of maintaining mules under the lot system of feeding. After the mules became thoroughly accustomed to the self-feeder, it was apparent that they were assured of a sufficient amount of feed at all times; consequently, the evidence of the "boss" mule disappeared and the younger, weaker, and more timid mules had plenty of time to receive their portion of the feed. The new system of feeding was so promising that it was considered advisable to build two large self-feeders for the second year's experiment and determine what the effect would be in maintaining large numbers of mules on self-feeders during the period of the year when the plantation work was most severe.

In a great many cases in the Delta region of the state, large portions of the grain feed is purchased on the market. Usually snapped corn is the sole concentrate used for work mules. There are seasons

when the corn is damaged somewhat and difficulty is experienced with digestive troubles with the mules being fed the damaged grain. Very few plantation owners purchase shelled corn for feeding. There seems to be an opinion that snapped corn is a much safer feed than shelled corn.

A carload of snapped ear corn was purchased on May 18, 1928, for feeding the mules on the Robertshaw plantation. The car of snapped corn weighed 44,600 pounds and the freight on the car was $80.28. Samples of the corn were accurately weighed, the shuck removed, and the corn shelled. It was found that 10 per cent of the weight of the corn was shuck and 14 per cent cob. On this basis, the shucks in this carload cost $66.92 and the cobs cost $93.69. The freight on the shucks and the cobs amounted to $19.26, or a total cost for the shucks and the cobs of $179.87. Market quotations on this date for car lots were $1.48 a bushel for snapped corn and $1.30 a bushel for number two yellow shelled corn in sacks. Bulk shelled corn was quoted at $1.27 per bushel.

Shelled corn was available for the second year's feeding test and it was planned to use some oats in the self-feeder to determine, if possible, what the results would be if oats and shelled corn were fed in separate compartments of the self-feeder at the same period. The large self-feeder, illustrated in figure 1, was constructed for use in the mule lot. This feeder was equipped with 30 doors, 16 inches wide and 2 feet high, and it was estimated that this feeder would provide sufficient trough space for about 50 head of mules. The feeder was ready for use in March and was in continuous use until the sixth of July, or 120 days. The following tabulation will summarize the results of this feeding period:

Ration	Shelled corn in self-feeder and available at all times
Average number of mules in lot	48
Average initial weight, 10 mules (lbs.)	1080
Average final weight, 10 mules (lbs.)	1183
Average gain in weight, 10 mules (lbs.)	103
Total mule days worked	3735
Average number days worked per mule	77.8
Average daily grain consumption per 1000 pounds live weight (lbs.)	13.4

The mules had free access to roughage in a hay rack under shelter throughout the period of the feeding test. The hay was raised on the plantation and varied in quality from good to inferior. Salt was kept before the mules at all times and artesian water was available in the feed lot. The mules were all branded with an individual number on the left arm for record and identification. Ten representative mules of the group were selected for weight records during the experimental period. Weights taken on three consecutive days at the beginning and the termination of the feeding test were averaged for the initial and final weights. Individual weights were taken at monthly intervals during the period of the test.

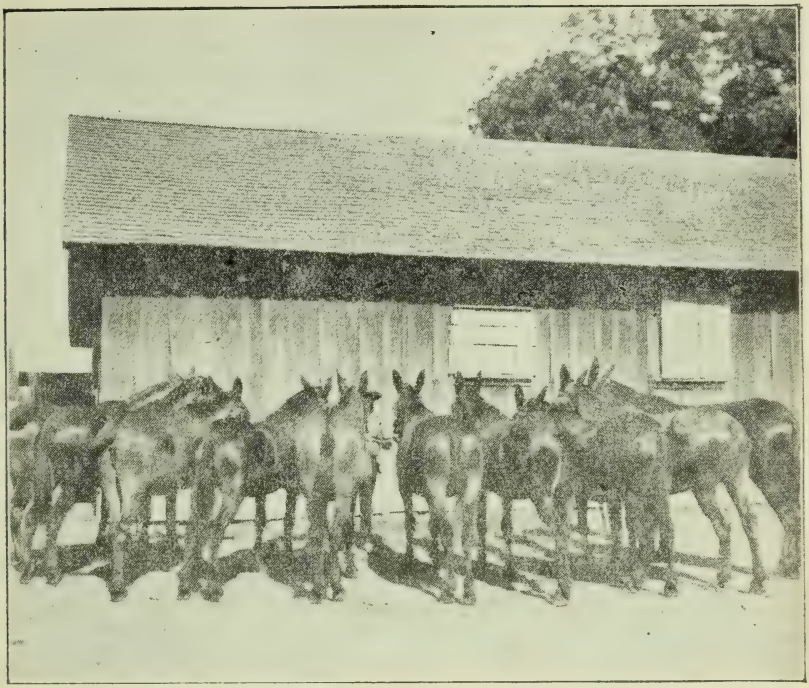


Figure 2—Ten representative mules from the self-feeder lot. Picture taken at the close of 120 day feeding period on self-feeder.

These mules consumed on the average 13.4 pounds of shelled corn per 1000 pounds live weight daily during the heavy work season and they made an increase of 103 pounds in live weight during the four months' period.

On the twentieth of June a car of number two bulk oats was purchased on the market. At this time the shelled corn that was in the feeder was all moved to one section of the hopper and the oats placed in another section, so the mules had free access to both kinds of grain. There was no noticeable difference in the way the mules consumed the two kinds of grain. They would eat a small amount of oats and then move to the other section and eat the corn. No record was kept as to the proportion of corn and oats consumed during the period of time when the mules had access to both feeds.

On another unit of the plantation, one side of a crib that was 60 feet long was reconstructed for self-feeding a lot of mules. Half of the crib was made into a form of hopper and a feed trough for the full length of the crib provided space for 38 doors which accommodated about 50 head of mules. A shed roof gave the mules full protection from the weather while using the self-feeder. Methods of feeding, keeping records of the weights of the mules, etc., were identical with

the self fed lot described above. One feature in the feeding practice with this self-feeder differed from the former. Where large numbers of mules are fed in the same lot, occasionally some of the mules remain idle during a part or all of the day. If these mules had free access to a self-feeder, they would have an opportunity to consume more feed than would probably be the case with mules that work all day. It was decided that it would be advisable to determine what effect there might be on the mules if the self-feeder was closed every morning when the mules went to work and remained closed throughout the day until all of the mules were returned to the feed lot at night. To make this study possible, the self-feeder was so constructed that a bar placed across the doors made it impossible for the idle mules to use the feeder during the day. All of the mules had free access to the grain from the time they were turned in the feed lot in the evening until they were removed from the lot for work the following day. Hay was available in feed racks and the mules had access to salt at all times. Artesian water was available in the feed lot.

The following tabulation summarizes the records for the feeding period of 120 days:

Ration	Shelled corn in self-feeder Feeder closed during day
Average number of mules in lot	49
Average initial weight, 12 mules (lbs.)	1145
Average final weight, 12 mules (lbs.)	1265
Average gain in weight, 12 mules (lbs.)	120
Total mule days worked	3874
Average number days worked per mule	79.0
Average daily grain consumption per 1000 pounds live weight (lbs.)	13.7

Twelve head of mules were selected from the 49 head for weight records. The picture used for a cover design on this bulletin will give the reader some conception of the quality and condition of the mules used in this phase of the test. The average grain consumption during the heavy work season was 13.7 pounds of shelled corn per 1000 pounds live weight. The 49 head of mules gained an average of a pound a day for the four month period.

RESULTS

The two lots of mules on the self-feeder for this year's test were not comparable, due to the fact that the quality of the roughage used in the two lots was not the same at all times, and the dates for changing the feeds in the self-feeder were not the same. Whether or not the self-feeder remained open throughout the day and night or closed during the day apparently was a negligible factor. When the mules become accustomed to a certain time of feeding, they seem to adjust themselves to the system. Apparently the regularity of feeding is more important than the length of time the feed is available, provided all the mules have an opportunity to receive a sufficient amount of feed to meet the requirements of their bodies.

Only 11 cases of digestive troubles occurred with the 97 head of mules during the months of April, May, and June. All cases were very

light with the exception of one. A severe case of colic rendered a mule unfit for service for a period of eight days. The previous record of this mule shows that he is susceptible to colic and three of the above cases were with this individual.

With both self-feeders half of the doors were propped open during the first day of the feeding period and all remained closed for the rest of the test. The mules became accustomed to this system of feeding very readily and within a three day period the most timid mules in the lot were receiving their portion of the feed. At night when the 49 head of mules were brought in from the field and turned into the feed lot, it was very apparent that the mules were satisfied they would get their portion of the feed, for there was no evidence of rushing to the feed trough. Some of the mules would go direct to the self-feeder and start eating grain, others would go to the hay rack, while some would go to the water trough, and still others would roll before they attempted to start feeding. In most cases the mules would eat a small portion of grain and then go to the hay rack and water trough or vice versa. It would be an unusual case when more than 10 or 12 of the 49 head in the lot would use the self-feeder at one time.

CONCLUSIONS

1. The self-feeder has proved to be an excellent system for feeding large groups of farm work mules.

2. The grain consumption per 1000 pounds live weight daily has averaged from 13.4 pounds of shelled corn to 13.7 pounds. These amounts are in line with the amount of concentrates consumed by mules under the lot feeding system.

3. The self-feeder system has practically eliminated the "boss" mule; consequently, the old, weak, and timid mules have equal opportunity for feeding and the lot of mules so fed maintained a satisfactory and uniform condition of flesh.

4. Self-feeders with large storage capacity economize very materially on the amount of labor required to feed mules.

5. From the very small number of digestive troubles that have developed during the two years of the experiments, it was very evident that there was considerably less trouble from digestive disorders with mules being self-fed than usually occurs where mules are lot fed.

PART II

GRINDING OF SHELLED CORN AND EAR CORN FOR WORK MULES

It has generally been conceded that work mules with good teeth masticate and digest home grown feeds with very little waste. Very little experimental data has been collected as to the influence of grinding grains for work animals. Corn, the chief concentrate used on southern farms, is almost universally fed without any preparation. With the increasing cost of grain feeds, the more readily available power on the farms for grinding, and the more efficient machines on the market for preparing feeds, the question of the advisability of grinding corn for work mules is constantly becoming a more acute problem.

The experiment reported in this part of the bulletin was planned to throw some light on the economy and effect of grinding shelled corn and ear corn for work mules.

OBJECTS OF THE EXPERIMENT

The object of this experiment was to determine what effect the grinding of shelled corn and ear corn would have on the mules doing heavy work and determine what saving there might be in the cost of the feed due to grinding.

PLAN OF THE INVESTIGATION

Eleven pairs of mules were used in this experiment. Six teams were used in the study of the grinding of shelled corn, and five teams for the ear corn investigation. They were divided into four lots in such a manner as to place team mates in Lots I and II and Lots III and IV. The rations for the four lots were as follows:

Lot I—Shelled corn and Johnson grass hay
Lot II—Shelled corn ground and Johnson grass hay
Lot III—Ear corn and Johnson grass hay
Lot IV—Ear corn ground and Johnson grass hay

Three periods of five months each were used in this test. The first period started March 15, 1928, and was concluded on August 11, 1928. At the close of the first period, the lots were reversed so that the mules that received the shelled corn for the first 150 day period were fed shelled corn ground for the second period, and the mules that received ear corn for the first period were fed ear corn ground for the second period of the test. The second period started on September 19, 1928, and was concluded on February 8, 1929, a total of 150 days. Again the two pairs of lots of mules were reversed, as indicated for the close of the first period. The third feeding period extended from March 24 to August 4, 1929. The reversal of the two comparable lots at the close of the first and second feeding period were made to eliminate as far as possible, the factor of individuality of the mules in the lots being compared.

MULES USED

Twenty of the 22 head of mules used in this experiment were raised on the Experiment Station farm. Each pair was mated as evenly as possible as to gait, quality, and type. The following list gives the age and the average weight of the mules of each pair at the beginning of the experiment:

Name				Name			
Lot I	Lot II	Age	Weight	Lot III	Lot IV	Age	Weight
Will		8	1202	Jake		14	1368
	Grace	3	1197		Jane	14	1398
Blue		12	1218	Della		14	1238
	Ida	6	1152		Nell	13	1175
Fly		9	1157	Mandy		12	1117
	Pat	8	1320		Molly	11	1160
Eva		5	1220	Beck		13	1166
	Jim	5	1168		Dave	10	1155
Henry		3	1153	Kate		8	1285
	Mike	7	1192		Maude	8	1312
Ada		4	1103				
	Red Rock	8	1250				

The mules in all four lots were carrying about the desired amount of flesh, so the rations for the grinding experiment were planned to about maintain the weight of the mules throughout the year.

FEEDS USED

Mosby corn that was raised on the Experiment Station farm was fed to Lots I and II for the first and second period of the experiment and from March 8 to June 1 in the third period. A number 2 yellow corn purchased on the market was fed to these lots from the first of June to the fourth of August during the third period. Mosby corn was the chief variety used in Lots III and IV throughout the test. Small amounts of several other varieties that were grown in the experimental plots were fed from time to time, but both lots received the same kind of corn at the same periods. The Johnson grass hay used throughout the experiment was produced on the Station farm. There were times when the quality varied somewhat, but on the average it graded number 1 with small amounts of number 2. Comparable lots received the same quality of hay at the same periods of the test. The shelled corn fed to Lot II and the ear corn fed to Lot III was ground at frequent intervals so the feed would deteriorate as little as possible before being fed. The shelled corn was ground to a degree of fineness that approached more closely that of corn meal than of corn chops. The ear corn was ground to a degree of fineness that was about midway between that of corn meal and corn chops.

Average Percentage Composition of Corn Used

	Water	Ash	Protein	Crude Fiber	Nitrogen Free Extract	Fat
Shelled corn fed to Lots I and II	11.29	1.57	9.28	3.01	70.22	4.62
Yellow corn fed to Lots I and II	11.18	1.50	9.63	2.77	70.72	4.20
Grain of ear corn fed to Lot III	11.75	1.50	9.00	3.25	70.06	4.44
Ear corn ground fed to Lot IV	11.00	1.65	7.81	6.62	69.04	3.88

FEEDING AND MANAGEMENT

The mules were fed in individual box stalls. The grain was fed in equal amounts morning, noon, and night. The hay was all fed at night. The mules had free access to salt at all times. When working, the mules were given water when they were taken from the stalls and when they returned from work. On Sundays and idle days, the noon feed was omitted. When not at work, the mules were fed their regular ration morning and evening and turned on a pasture. During the warm season, they were turned out at night after they had finished eating.

Records and accurate weights of all feeds offered and refused were kept during the experiment. The initial and final weights of the mules consisted of an average of three weights made on consecutive days. Individual weights were taken of the mules every Monday morning after they were fed and watered. Records were kept of the number of days that each mule worked, and of the health of the mules, and of any unusual circumstances which occurred during the experiment.

RESULTS OF THE INVESTIGATION

Rations Fed, Weight Records, and Days Worked. The rations for the four lots of mules were figured on the basis of 1000 pounds live weight per head per day. The roughage for each of the lots remained constant throughout the three periods and consisted of 12 pounds of Johnson grass hay. Lot I was fed 12 pounds of shelled corn. In Lot II, it was planned to reduce the ground shelled corn 10 per cent, so this lot received only 10.8 pounds of shelled corn ground. Lot III was fed on the basis of receiving enough ear corn to make the equivalent of 12 pounds of shelled corn. As the proportion of cob to shelled corn varied, 14.28 pounds of ear corn was fed for the first two periods, and 14.16 pounds of ear corn was fed to this lot for the third period. Lot IV was to receive enough ear corn ground so that it would have the equivalent of 90 per cent of the shelled corn fed in the form of ear corn to Lot III. For the first two periods of the test 12.85 pounds of ear corn ground and for the third period 12.74 pounds of ear corn ground was fed to Lot IV.

Table 2 summarizes the results of this experiment for the rations fed, weights of the mules, and records of the days worked:

Table 2—Rations Fed, Weight Records, and Days Worked

Ration per 1000 lbs. live weight per day	Lot I 12 lbs. Shelled corn 12 lbs. Johnson grass hay	Lot II 10.8 lbs. Shelled corn ground 12 lbs. Johnson grass hay	Lot III 14.22 lbs. Ear corn* 12 lbs. Johnson grass hay	Lot IV 12.79 lbs. ear corn ground** 12 lbs. Johnson grass hay
Number of mules	6	6	5	5
Average initial weights for 3 periods (lbs.)				
March 14, 1928	1187.	1213.	1235.	1240.
September 12, 1928	1224.	1194.	1191.	1151.
March 6, 1929	1201.	1238.	1214.	1267.
Average final weights for 3 periods (lbs.)				
August 11, 1928	1166.	1189.	1158.	1204.
February 8, 1929	1244.	1203.	1272.	1224.
August 4, 1929	1221.	1233.	1195.	1209.
Gain or loss in weight (lbs.)	-6.33	-6.67	-5.00	-7.00
Total mule days worked for 3 periods				
First period	567.50	577.50	446.50	438.25
Second Period	524.00	539.50	280.75	269.00
Third Period	595.00	597.50	353.75	340.25
Average number of mule days worked per lot	562.17	571.50	360.33	349.17
Average number of mule days worked per mule per period	93.69	95.25	72.06	69.83

*14.28 pounds of ear corn was fed to Lot III for the two periods of 1928-29.
14.16 pounds of ear corn was fed to Lot III for the third period in 1929.
**12.85 pounds ear corn ground was fed to Lot IV for the two periods of 1928-29.
12.74 pounds ear corn ground was fed to Lot IV for the third period in 1929.

It will be observed from the above table that the rations fed to the four lots of mules were, on the average, satisfactory for maintaining their live weight for the three periods of 150 days each.

There was a very slight variation in the amount of work done by the mules in Lot I and Lot II and the mules in Lot III and Lot IV, but the small difference in this factor for comparable lots is considered insignificant.

Charts number 1, 2, and 3, give the average live weight of the mules fed the shelled corn and shelled corn ground for the three periods of five months each. The charts also give the record for the mule days worked per week throughout the period of the test. A temperature curve for each period indicates the average maximum temperatures for the six working days of the week.

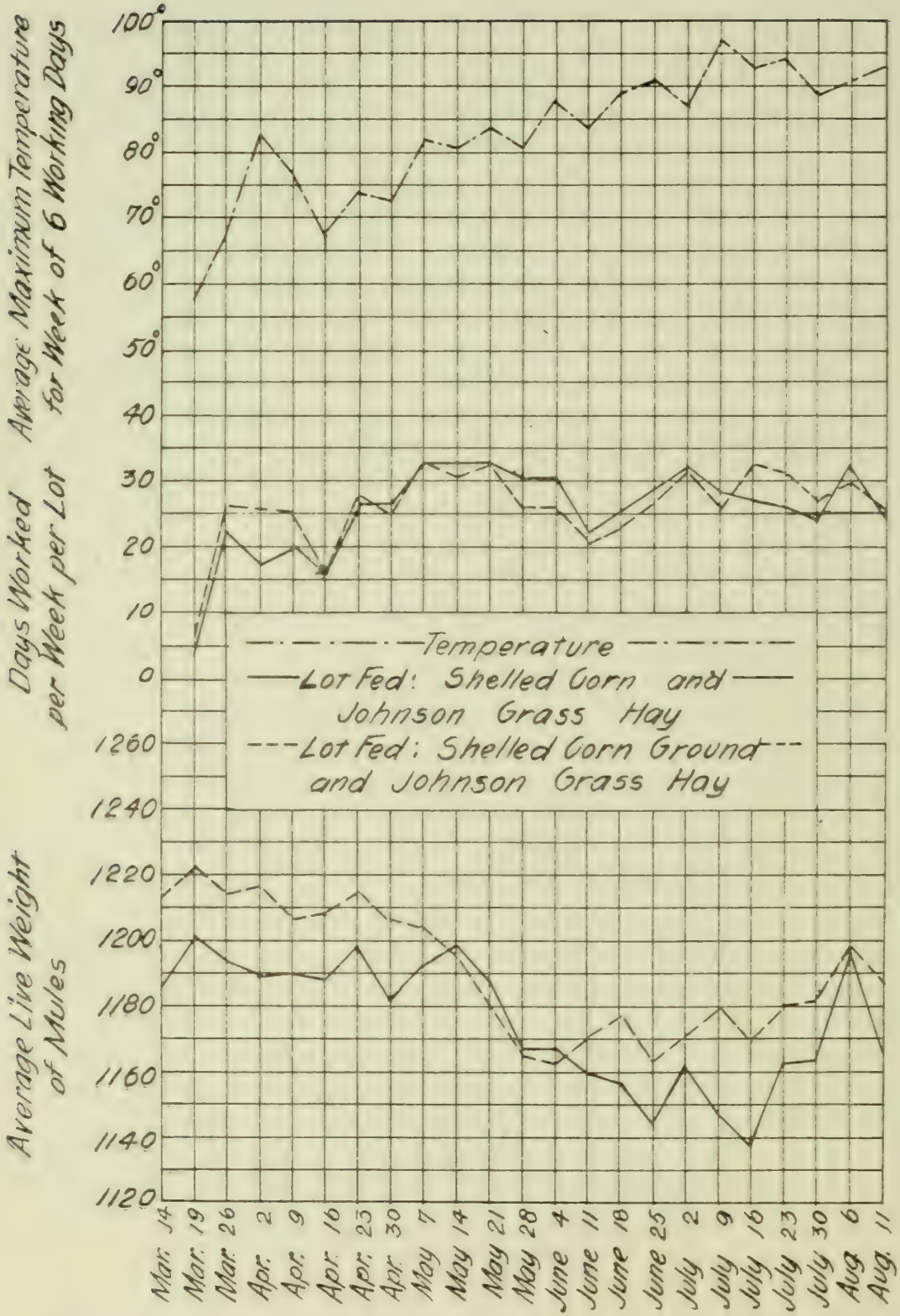


Chart 1—Curves showing average weights for mules in Lots I and II, days worked, and average maximum temperatures for the first period of the experiment.

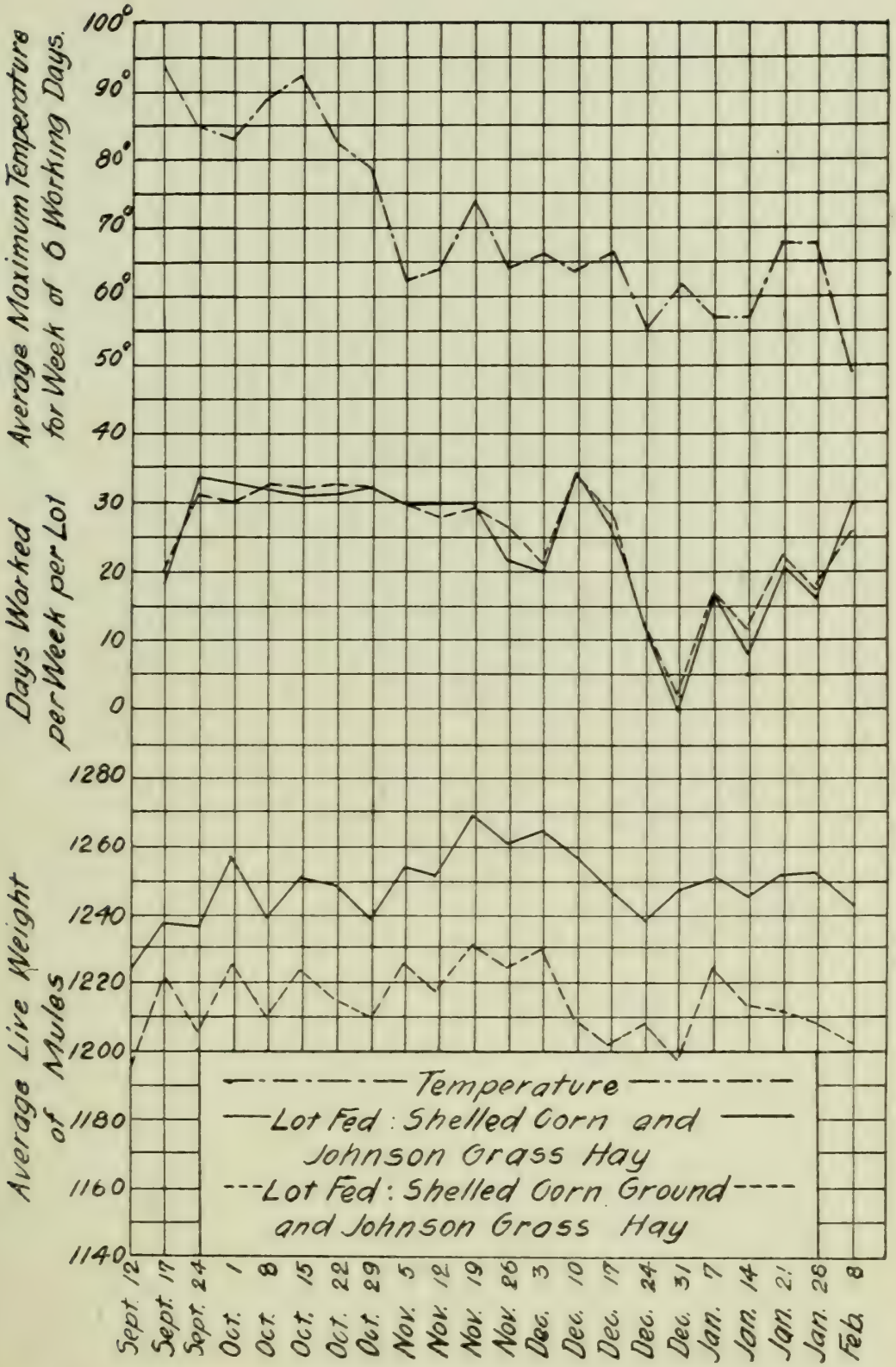


Chart 2—Curves showing average weights for mules in Lots I and II, days worked, and average maximum temperatures for the second period of the experiment.

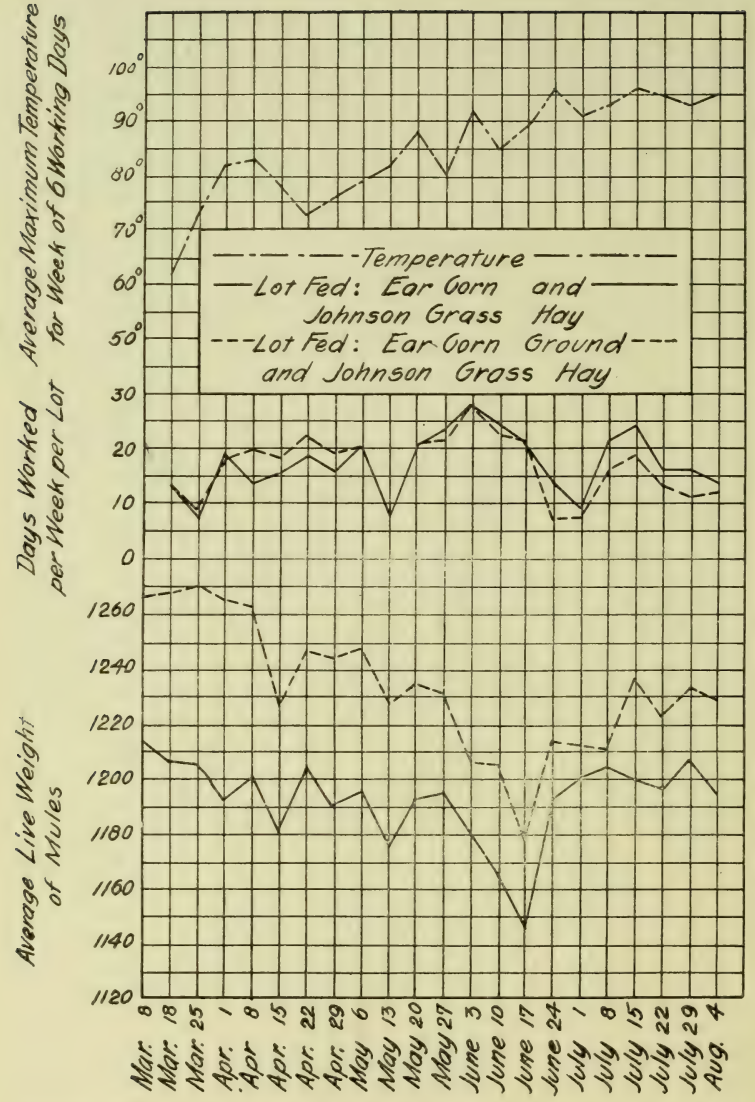


Chart 3—Curves showing average weights for mules in Lots I and II, days worked, and average maximum temperatures for the third period of the experiment.

The total amount of work for each lot throughout the three periods of five months each was very uniform. The rations fed to Lots I and II for the first period of March 14 to August 11, were hardly sufficient to maintain the live weight of these two groups of mules during the period of the year when they were doing heavy farm work. The rations in both instances proved satisfactory for maintaining the two groups of mules during the second and third periods of the test. A close examination of the changes in live weight for these two lots of mules throughout the three periods of five months each indicated that there was no appreciable difference in the rations fed to Lots I and II for maintaining their live weight. On the basis of this experiment, the grinding of shelled corn fed to Lot II made a saving of 10 per cent of the shelled corn.

Charts 4, 5, and 6 give detail information as to the changes in live weight that occurred in the group of mules fed in Lot III on the ear corn ration and the group of mules in Lot IV that received the ear corn ground ration. Curves also indicate the total amount of days worked per lot per week, and the maximum temperatures for the working days of each week are given in the curve indicating temperatures for each of the three periods.

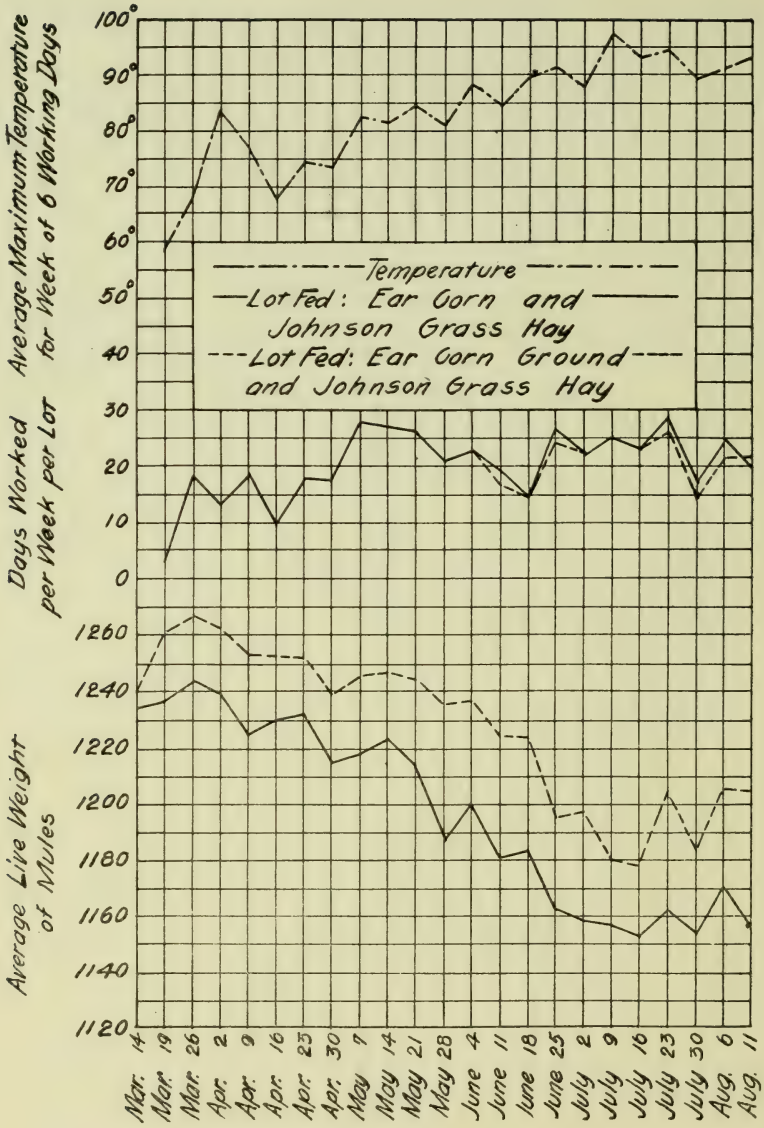


Chart 4—Curves showing average weights for the mules in Lots III and IV, days worked and average maximum temperatures for the first period of the experiment.

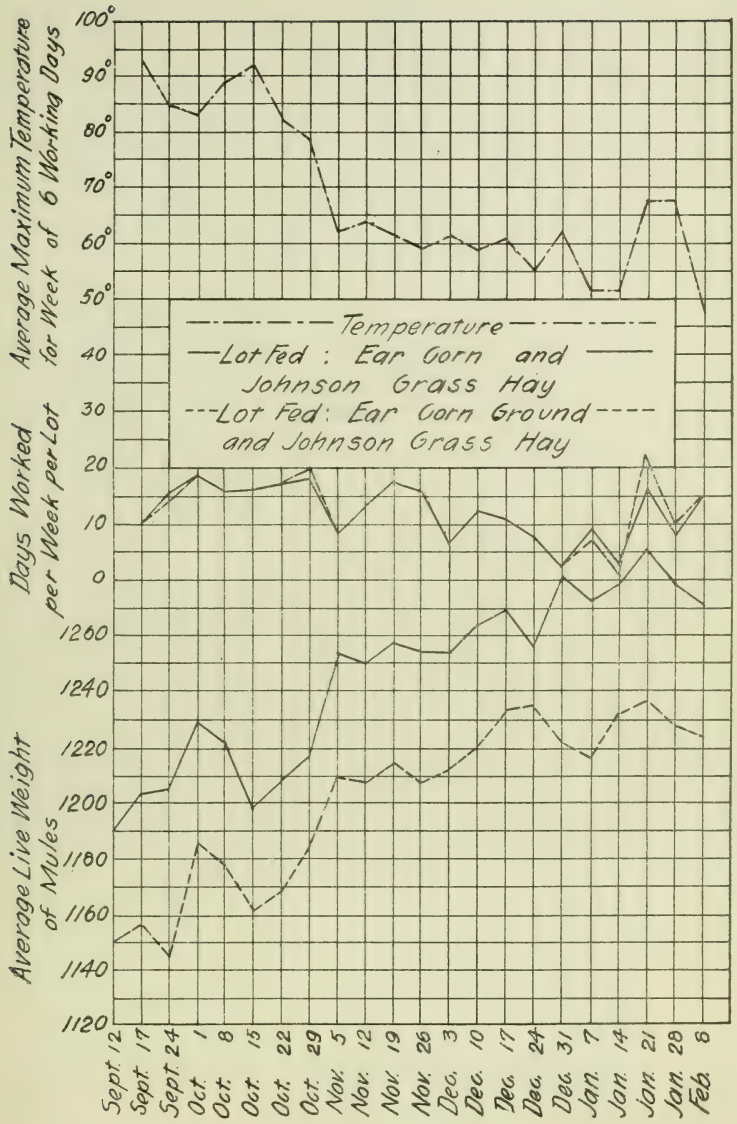


Chart 5—Curves showing average weights for the mules in Lots III and IV, days worked, and average maximum temperatures for the second period of the experiment.

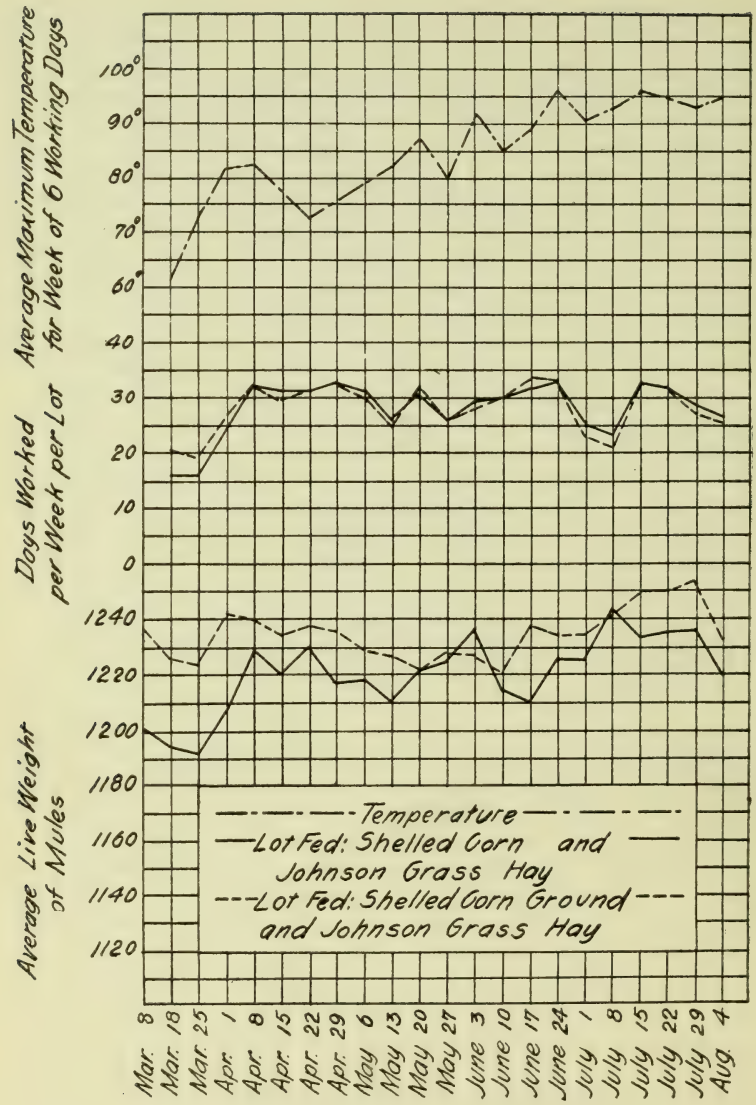


Chart 6—Curves showing average weights for the mules in Lots III and IV, days worked, and average maximum temperatures for the third period of the experiment.

The amount of work that the two lots were doing throughout the period of the test was very uniform. The small difference in work done by the two lots is insufficient to be considered a factor in the live weight of the two groups of mules. The rations fed Lots III and IV were not quite sufficient to maintain the live weights of the mules in these two groups during the heavy work period of March 14 to August 11, the first period of the experiment. During the second period of the test, both lots of mules increased considerably in live weight; and again during the third period when the work was somewhat more severe the mules in both lots lost slightly in body weight. On the average for the three periods, there is no material difference in the efficiency of the rations fed to Lots III and IV for maintaining the weight of the mules when they are at work. On the basis of this experiment, there was a saving of about ten per cent of ear corn due to grinding.

Maintenance of Health of the Mules. During the three periods of five months each that shelled corn and shelled corn ground were being compared, one case of colic developed in the shelled corn lot and three cases of colic in the shelled corn ground lot. All four cases were of a mild form.

During the three periods of five months each that ear corn and ear corn ground were being compared, one case of colic developed in the group of mules being fed ear corn and two cases of colic with the mules being fed the ear corn ground. All three cases were of a mild form.

Fig. 3—Mule Feeding Barn, Mississippi Experiment Station.

PART III

JOHNSON GRASS VERSUS SOYBEAN HAY FOR FEEDING WORK MULES

There has been an enormous increase in the acreage planted to soybeans in Mississippi and throughout the South during the past few years. With the large number of varieties that are available, it is possible to select one that is adapted to almost any soil type or condition in the South; and it is possible, by utilizing the different varieties, to plant this crop from the middle of March to the middle of July.

The soybean gives a larger tonnage of hay per acre than any other annual legume hay crop grown in this territory. This crop is practically free of diseases and parasites, and the plant is not affected by periods of drouth or excessive moisture as are most of the legumes grown in this section. The soybean is an excellent crop for building up depleted soils.

At the present time, there are no official hay standards for soybean hay, and with the increasing tonnage that is being produced each year, there is a demand for information as to the relative feeding value of this hay.

The following tabulation gives the digestible nutrients in the principal legume and grass hays that are fed in the South*:

	Total Dry Matter in 100 lbs.	Digestible Nutrients in 100 lbs.			
		Crude Protein	Carbohydrates	Fat	Total
Hay from the legumes—					
Alfalfa, all analyses	91.4	10.6	39.0	0.9	51.6
Soybean	91.4	11.7	39.2	1.2	53.6
Cowpea, all analyses	90.3	13.1	33.7	1.0	49.0
Lespedeza	88.2	8.6	41.1	1.1	52.2
Peanut vine, mowed	81.9	7.0	38.4	3.3	52.8
Hays from the grasses—					
Johnson grass	89.9	2.9	45.0	1.0	50.1
Bermuda grass	90.3	3.7	37.9	0.8	43.4
Timothy, all analyses	88.4	3.0	42.8	1.2	48.5

Official hay standards have been adopted for Johnson grass hay, and as this crop is grown and fed extensively in the South, an experiment was planned to test the relative feeding value of soybean hay and Johnson grass hay.

OBJECTS OF THE EXPERIMENT

The object of this experiment was to compare the relative feeding value of soybean hay and Johnson grass hay for feeding mature mules doing heavy work.

*Feeds and Feeding, 18th edition.

PLAN OF THE INVESTIGATION

Five pairs of mules were used in this experiment in 1925-26, six pairs in 1926-27, and five pairs in 1927-28. They were divided into two lots in such a manner as to place team mates in Lot I and in Lot II. The rations for the two lots were as follows:

Lot I—Ear corn and Johnson grass hay
Lot II—Ear corn and Soybean hay

Six periods of 150 days each were used in this test. The first period started on March 2 and was concluded on July 29, 1925. The second period was from September 14, 1925, to February 10, 1926. The third period extended from March 22 to August 18, 1926. The fourth period started on September 27, 1926, and was concluded on February 3, 1927. The fifth period extended from March 5 to August 4, 1927. The sixth period was from September 12, 1927, to February 8, 1928.

At the beginning of the experiment, Lot I was fed ear corn and Johnson grass hay and Lot II was fed ear corn and soybean hay. At the close of the five months periods, the lots were reversed so that the mules that received the Johnson grass hay for the first period received the soybean hay for the second period. The exchange of lots occurred at the end of each period; consequently, during the three years of the test the mules in Lot I received the Johnson grass hay in the first, third, and fifth periods and they were given the soybean hay in the second, fourth, and sixth periods. The mules in Lot II received the comparable ration at the same periods. The reversal of the two lots was made to eliminate as far as possible the factor of individuality among the mules in the lots being compared. At the beginning of each period, about two weeks time was required to make the exchange of rations.

MULES USED

The 12 head of mules used in this experiment were all raised on the Experiment Station farm. The following list gives the ages and the average weights of the mules of each of the pairs at the beginning of the experiment:

Name			
Lot I	Lot II	Age	Weight
Alice		9	1110
	Will	5	1216
Pigeon		7	1246
	Blue	9	1180
Pat		5	1248
	Fly	7	1175
Nell		10	1326
	Jessie	8	1303
Red Rock		5	1202
	George	8	1228
Mike		5	1180
	Eva	4	1122

The mules used in these two lots were carrying the desired amount

of flesh. The rations for the test were figured on the basis of maintaining as nearly as possible the initial weights of the mules in the two lots.

FEEDS USED

Mosby corn that was raised on the Station farm was used practically throughout the three years of the test. For two short periods of time, it was necessary to supplement the Mosby corn with a number 2 yellow corn that was purchased on the market, but as the change of corn was made at uniform times for both lots, this factor did not influence the test being made with the two kinds of hay.

Ototan soybean hay was used during the first year. This hay was very stemmy and at the time of cutting the crop a large number of the beans were mature. In the curing process, the leaves adhered to the stems and the hay was green in color. Laredo soybean hay was the variety used in 1926-27. The soybean hay of this year was much finer in quality than of the previous year. The stems were much smaller and the leaves adhered in the curing process, but the hay was slightly damaged by rain before it was baled. The Laredo soybean hay used for the 1927-28 comparison was about of the same texture as for 1926-27 and the hay was put up without any damage by the weather.

The Johnson grass hay was raised on the Station farm and was of good quality. Most of each crop that was fed in this experiment rated number 1, with small amounts grading number 2.

	Water	Ash	Protein	Crude Fibre	Nitrogen Free Extract	Fat
Ototan soybean hay—1925-26	7.92	6.60	9.87	34.26	36.54	2.89
Laredo soybean hay—1926-27	7.86	8.20	10.84	37.09	33.88	1.53
Laredo soybean hay—1927-28	6.04	5.56	10.22	30.60	39.04	2.51
Johnson grass hay—3 years	7.25	6.83	6.04	33.10	45.20	1.34

FEEDING AND MANAGEMENT

The mules were fed in individual box stalls. The grain was fed in equal amounts morning, noon, and night. The hay was all fed at night. The mules had free access to salt at all times. When working, the mules were given water when they were taken from the stalls and when they returned from work. On Sundays and idle days, the noon feed was omitted. When not at work, the mules were fed their regular ration morning and evening and turned on a pasture. During the warm season, they were turned out at night after they had finished eating.

Records and accurate weights of all feeds offered and refused were kept during the experiment. The initial and final weights of the mules consisted of an average of three weights made on consecutive days. Individual weights were taken of the mules every Monday morning after they were fed and watered. Records were kept of the number of days that each mule worked, and of the health of the mules, and

of any unusual circumstances which occurred during the experiment.

RESULTS OF THE INVESTIGATION

Rations Fed, Weight Records, and Days Worked. In previous experiments a ration consisting of 13.7 pounds of ear corn and 12 pounds of Johnson grass hay per 1000 pounds live weight per day maintained the weight of the mules very satisfactorily throughout the year, so this ration was used for Lot I for the present experiment. In figuring the ration for Lot II, the same amount of corn was utilized as for Lot I and enough soybean hay was used in the ration to make the total digestible nutrients for the two lots as nearly equal as possible. A progress report for the first year's test of this experiment was published in Mississippi Experiment Station Bulletin 244. The rations for both lots proved satisfactory for the test, so there were no changes made in the amounts of concentrates or roughages for the following two years.

During the first year's test, the soybean hay was very rank and stemmy, some of the stems measuring three-eighths inch at the base. As the amount of roughage was limited for both lots, the Johnson grass hay was consumed without any waste whatever and there was not enough waste of the soybean hay to be considered a factor in the experiment. During the second and third year's tests the soybean hay was of fine quality and no waste was experienced.

Table 3 summarizes the results of this experiment for the six 150 day periods as to rations fed, weights of mules, and days worked.

Table 3—Rations Fed, Weight Records, and Days Worked

Ration per 1000 lbs. live weight per day	Lot I 13.7 lbs. Ear corn 12.0 lbs. Johnson grass hay	Lot II 13.7 lbs. Ear corn 11.0 lbs. Soybean hay
1925-26		
Number of mules	5	5
First period—March 2 to July 29, 1925		
Average initial weight (lbs.)	1226	1220
Average final weight (lbs.)	1230	1254
Gain or loss (lbs.)	4	34
Second period—September 14, 1925, to February 10, 1926		
Average initial weight (lbs.)	1273	1247
Average final weight (lbs.)	1262	1278
Gain or loss (lbs.)	-11	31
1926-27		
Number of mules	6	6
First period—March 22, to August 18, 1926		
Average initial weight (lbs.)	1235	1243
Average final weight (lbs.)	1258	1237
Gain or loss	23	-6
Second period—September 27, 1926, to February 3, 1927		
Average initial weight (lbs.)	1253	1274
Average final weight (lbs.)	1249	1235
Gain or loss (lbs.)	-4	-39
1927-28		
Number of mules	5	5
First period—March 5, to August 4, 1927		
Average initial weight (lbs.)	1210	1206
Average final weight (lbs.)	1199	1199
Gain or loss (lbs.)	-11	-7
Second period—September 12, 1927, to February 8, 1928		
Average initial weight (lbs.)	1240	1208
Average final weight (lbs.)	1218	1198
Gain or loss (lbs.)	-22	-10
Average of Six 150 Day Periods		
Average initial weight (lbs.)	1239	1233
Average final weight (lbs.)	1236	1234
Gain or loss (lbs.)	-3	1
Total Mule Days Worked		
First period, 1925-26	479.	459.
Second period, 1925-26	300.2	274.7
First period, 1926-27	539.75	553.75
Second period, 1926-27	363.75	450.75
First period, 1927-28	535.70	491.45
Second period, 1927-28	425.92	407.17
Average Mule Days per 150 Day Period		
Total mule days worked	2344.12	2145.37
Average for six periods	390.68	357.56
Average per mule per period	73.3	67.0

It will be noted from the foregoing table that on the average for the six experimental periods of 150 days each the Johnson grass hay ration fed to Lot I and the soybean hay ration fed to Lot II were very efficient in maintaining the weights of the mules in the two lots throughout the experimental periods. The loss of weight for the Johnson grass hay mules, Lot I, was only three pounds for the experimental period, while the soybean hay group of mules gained on the average of one pound.

The average number of mule days worked per period was 73.3 days for the mules of Lot I and 67 days for Lot II. There is not enough difference in the amount of work done by the two lots of mules to be considered a factor in influencing their body weights.

Maintenance of Health and Ability to Endure Work and Hot Weather. During the entire period of the experiment, there was no case of illness that could be traced to the rations that the mules received. Both rations were palatable and satisfactory. However, it was apparent that the soybean hay was relished more by the mules than was the Johnson grass hay. There was no noticeable difference between the mules of the two lots as to the way they stood their work and the heat, nor was there any difference in the spirit of the two lots.

The following table summarizes the results of the experiment:

Table 4—Summary of Data on the Relative Feeding Value of Johnson Grass Hay and Soybean Hay

Ration per 1000 lbs. live weight per day	Lot I 13.7 lbs. Ear corn 12.0 lbs. Johnson grass hay	Lot II 13.7 lbs. Ear corn 11.0 lbs. Soybean hay
Number of mules	5 and 6	5 and 6
Length of test (days)	1800	1800
Average initial weight (lbs.)	1239	1233
Average final weight (lbs.)	1236	1234
Average gain or loss in weight (lbs.)	-3	1
Total mule days worked, 6 periods	2344.12	2145.37
Average days worked per mule per period	73.3	67.
*Estimated consumption of feed per year on basis of 1000 lbs. live weight		
Ear corn (lbs.)	4103.	4103.
Johnson grass hay (lbs.)	4380.	.....
Soybean hay (lbs.)	.....	4105.
Cost of ration per year	$80.36	$80.36
Cost of ration per day	22.02c	22.02c

Cost of Feeds

Corn	$ .87 per bushel
Johnson grass hay	12.00 per ton
Soybean hay	13.09 per ton

On the basis of this experiment, one ton of soybean hay would be worth $13.09 with Johnson grass hay costing $12.00 per ton.

*Mules were fed on the basis of their live weight. On idle days the noon feed of concentrates was omitted.

The changes in body weights of the mules for the six experimental periods of 150 days each show clearly that there is little, if any, difference in the efficiency of these two rations in maintaining the live weight of the mules while at heavy work. There was no noticeable difference in the spirit or ability to stand the work and heat of the mules consuming the ear corn—Johnson grass hay ration and those consuming the soybean ration.

On the basis of this experiment, 12 pounds of Johnson grass hay was the equivalent of 11 pounds of soybean hay. With the prevailing prices of 87 cents a bushel for corn and $12.00 a ton for Johnson grass hay, the soybean hay was worth $13.09 a ton.

PART IV

STALL VERSUS LOT FEEDING OF WORK MULES

There are two systems of feeding mules in use in the South. On the small farms and plantations mules are generally fed individually in stalls, but on the large farms and plantations, in lumber camps, and with construction outfits, large numbers of work mules are fed in lots.

In lot feeding, the principle involved is to feed enough concentrate and roughage each day so that the mules have access to the feed at all times. Some feeders make a practice of putting out enough feed at one time to last for a day, while others put the feed in the lots twice a day. The usual practice in both cases is to have a small amount of feed left over for the next feeding period to insure the weaker, more timid, and younger mules securing their portion. Mules accustomed to this system of feeding suffer very little from digestive disorders after they are on full feed. It would seem that this system of feeding would be rather wasteful in that in all probability the mules would consume more feed than was necessary to maintain them in proper condition. In comparing the two systems, some feeders claim that the time saved in feeding under the lot-fed system would more than offset any saving in feed that would be brought about by stall-feeding the mules.

In the stall-feeding of mules, it would be easier to detect mules that were "off feed," and consequently they could be given proper treatment more promptly than if the mules were being lot-fed. Feeders who have had considerable experience in stall feeding mules say that they would have less trouble with colic and other digestive disorders by using this system of feeding.

To obtain data on these two systems of feeding, the following experiment was planned.

OBJECTS OF THE EXPERIMENT

The object of the experiment was to compare stall versus lot-feeding of mules. Especial attention was given the following points:

Health of the mules.
Ability to endure hard work and hot weather.
Maintenance of weight and condition.
Degree of spirit maintained.
Economy of the two systems of feeding.

PLAN OF THE INVESTIGATION

Six pairs of mules were used in this experiment in 1925-26 and 1926-27. Five pairs were used in 1927-28. The teams were divided into two lots in such a manner as to place team mates in Lot I and Lot II. The rations per 1000 pounds live weight per day for the two lots were as follows:

Lot I—Stall Fed—13.7 pounds ear corn and 12 pounds Johnson grass hay.

Lot II—Lot Fed—Ear Corn ad libitum and Johnson grass hay ad libitum. (Average amount of feed consumed for the six periods—15.15 pounds ear corn and 11.29 pounds Johnson grass hay).

Six periods of 150 days each were used in this test. The first period started on March 2 and was concluded on July 29, 1925. The second period was from September 14, 1925 to February 10, 1926. The third period extended from March 22 to August 18, 1926. The fourth period started on September 27, 1926 and was concluded on February 3, 1927. The fifth period extended from March 5 to August 4, 1927. The sixth period was from September 12, 1927, to February 8, 1928.

At the beginning of the experiment, Lot I was stall fed ear corn and Johnson grass hay. Lot II was fed ear corn and Johnson grass hay ad libitum. At the close of the five months period, the lots were reversed so that the group of mules that were stall fed for the first period were lot fed for the second period. The exchange of lots occurred at the end of each period; consequently, during the three years of the test the mules in Lot I were stall fed for the first, third, and fifth periods, and they were lot fed for the second, fourth, and sixth periods. The mules in Lot II received the comparable type of feeding at the same periods. The reversal of the two lots was made to eliminate as far as possible the factor of individuality among the mules in the lots being compared. At the beginning of each period, about two weeks of time were required to make the exchange of the rations.

MULES USED

Ten of the 12 mules used in this experiment were raised on the Experiment Station farm. Kate and Maude, both mature mules, were purchased on the local market. The following list gives the age and average weight of the mules of each pair at the beginning of the experiment:

Name			
Lot I	Lot II	Age	Weight
Jake		11	1232
	Jane	11	1362
Della		11	1150
	Nell	10	1112
Mandy		9	1028
	Molly	7	1003
Mike		4	1045
	Eva	3	980
Dave		7	958
	Beck	10	960
Kate		5	1133
	Maude	5	1192

All of the mules in both lots were in good condition when the

experiment was inaugurated.

FEEDS USED

The ear corn and Johnson grass hay used in this experiment were of the same quality as used in the test comparing Johnson grass hay and soybean hay.

FEEDING AND MANAGEMENT

The mules in Lot I were fed in individual box stalls. The grain fed to this lot was divided into three equal feeds, the hay all being fed at night. Salt was available to these mules in their stalls at all times. The mules were watered after the morning feed and before the night feed. When working, they were always given water when they were taken from their stalls and when they returned from work. On Sundays and on idle days, the noon feed was omitted. When not at work, the mules in this lot were turned into a dry lot for exercise. During the warm season, the mules in Lot I were turned out at night after they had finished eating.

The mules in Lot II were fed the grain part of their ration in two feeds, at noon and night, the larger part of the grain being fed at the evening meal. Hay was fed at night. Enough corn and hay were fed at each feeding period so that there would be a small amount of feed left over for the next meal. The mules had free access to salt and water.

The lot in which these mules were confined during the test was 50 by 60 feet. A shed 12 by 60 feet was on the north side of the lot. A feed trough 24 feet long and a hay rack 20 feet long under the shed were utilized for feeding.

Time Required to Feed the Two Lots. The time required to feed the mules under these two systems would vary according to the conveniences for doing the work, but in this experiment 26 minutes were required each day for feeding the stall-fed mules and 16 minutes for the lot-fed mules.

RECORDS

Accurate weights of all feeds offered and refused were kept during the experiment. The initial and final weights here presented consist of an average of three weights taken on consecutive days. Individual weights were taken of the mules every Monday morning after they were fed and watered. Records were kept of the number of days each mule worked and of the health of the mules and of any unusual circumstances which occurred during the experiment.

RESULTS OF THE INVESTIGATION

Rations Fed, Weight Records, and Days Worked. In previous experiments, a ration consisting of 13.7 pounds of ear corn and 12 pounds of Johnson grass hay per 1000 pounds live weight per day maintained the weight of the mules satisfactorily throughout the year, so this ration was used as a check ration to be fed to Lot I, the stall fed mules. The lot fed mules were fed according to their appetites. A progress report for the first year's test was made in Mississippi Experiment Station Bulletin 244. Table 5 summarizes the results of this experiment for the rations fed, weights of mules, and records of days worked.

Table 5—Rations Fed, Weight Records, and Days Worked

Ration per 1000 lbs. live weight per day	Lot III Stall Fed 13.7 lbs. Ear corn 12.0 lbs. Johnson grass hay	Lot IV Lot Fed Ear corn ad libitum Johnson grass hay ad libitum
1925-26		
Number of mules	6	6
First period—March 2, to July 29, 1925		
Average initial weight (lbs.)	1091	1101
Average final weight (lbs.)	1103	1181
Gain or loss (lbs.)	12	80
Second period—September 14, 1925 to February 10, 1926		
Average initial weight (lbs.)	1182	1134
Average final weight (lbs)	1131	1220
Gain or loss (lbs.)	-51	86
1926-27		
Number of mules	6	6
First period—March 22, to August 18, 1926		
Average initial weight (lbs.)	1139	1118
Average final weight (lbs.)	1127	1226
Gain or loss (lbs.)	-12	108
Second period—September 7, 1926, to February 3, 1927		
Average initial weight (lbs.)	1197	1182
Average final weight (lbs.)	1160	1236
Gain or loss (lbs.)	-37	54
1927-28		
Number of mules	5	5
First period—March 5, to August 4, 1927		
Average initial weight (lbs.)	1226	1180
Average final weight (lbs.)	1173	1275
Gain or loss (lbs.)	-53	95
Second period—September 12, 1927, to February 8, 1928		
Average initial weight (lbs.)	1264	1236
Average final weight (lbs.)	1256	1279
Gain or loss (lbs.)	-8	43
Average of Six 150 Day Periods		
Average initial weight (lbs.)	1183	1159
Average final weight (lbs.)	1158	1236
Gain or loss (lbs.)	-25	77
Total Mule Days Worked		
First period, 1925-26	601.3	560.8
Second period, 1925-26	404.5	372.0
First period, 1926-27	403.5	411.0
Second period, 1926-27	547.75	574.25
First period, 1927-28	415.25	422.0
Second period, 1927-28	256.09	257.79
Average Mule Days per 150 Day Period		
Total mule days worked	2728.39	2597.85
Average for six periods	454.73	432.97
Average per mule per period	83.3	81.2

The mules in Lots I and II were reversed at the end of each of the first five periods of the experiment to eliminate the factor of individual variation. The stall fed mules, Lot I, lost an average of 25 pounds for the six experimental feeding periods. Their team mates that were lot fed gained an average of 77 pounds for the six feeding periods. The stall fed mules worked an average of 83.3 days per period, while their team mates worked an average of 81.2 days for the six periods.

Maintenance of Health and Ability to Endure Work and Hot Weather. During the entire period of the experiment, there was no case of illness or digestive derangement of any kind in the stall fed group of mules. During the first year that the test was under way, there were no digestive troubles with the lot fed group of mules, but during the second year there were two light cases of colic, and during the third year one mild case of colic developed in this group. There was no noticeable difference in the spirit of the mules of the two lots or as to the way they stood their work and the heat. Both rations proved entirely satisfactory in these respects.

The following table summarizes the results of this experiment:

Table 6—Summary of Data on Stall versus Lot Feeding of Mules

	Lot I Stall Fed	Lot II Lot Fed
Ration per 1000 lbs. live weight per day	13.7 lbs. Ear corn 12.0 lbs. Johnson grass hay	Ear corn ad libitum Johnson grass hay ad libitum
Number of mules	5 and 6	5 and 6
Length of test (days)	1800	1800
Average initial weight (lbs.)	1183	1159
Average final weight (lbs.)	1158	1236
Average gain or loss in weight (lbs.)	-25	77
Total number mule days worked, 6 periods	2728.39	2597.85
Average days worked per mule	83.3	81.2
*Consumption of feed per year on the basis of 1000 lbs. live weight		
Ear corn (lbs.)	4237.	5529.
Johnson grass hay (lbs.)	4380.	4121.
Cost of ration per year	$82.12	$97.60
Cost of ration per day	22.49c	26.74c

Cost of Feeds

Corn	$ .87 per bushel
Johnson grass hay	12.00 per ton

*Mules were fed on the basis of their live weight. On idle days the noon feed of concentrates was omitted.

It will be noted from the foregoing table that the ration of ear corn and Johnson grass hay given to the stall fed mules did not maintain the initial weight of the mules for the six experimental periods of 150 days each, as this lot lost an average of 25 pounds. The lot fed mules gained consistently in every period of the experiment, mak-

ing an average increase in live weight of 77 pounds per mule for the six periods.

There was no noticeable difference in the ability of the mules of the two lots to do their work or to stand the warm weather, nor was there any difference in the spirit of the mules of the two lots.

The lot fed mules, fed ad libitum, consumed on the average for the six experimental periods 15.15 pounds of ear corn and 11.29 pounds of Johnson grass hay per 1000 pounds live weight per day. It will be noted that there was very little difference in the amount of hay consumed by the two lots, but the lot fed mules consumed 10.6 per cent more corn than the stall fed mules.

On the basis of this experiment, it cost $82.12 per year to maintain a 1000 pound mule doing heavy work when stall fed and $97.60 for the mules that were lot fed.

PART V

SALT REQUIREMENTS OF WORK MULES

Common salt or sodium chloride is a very essential part of the ration for a work mule. For best results the mules should have free access to this material at all times. Salt adds palatability to the ration and its chemical elements, sodium and chloride, play a very important part in digestion and in body metabolism. If salt is omitted from the ration or if this material is fed irregularly, digestive troubles may develop. A mule is very likely to show this deficiency in his ration by his coat of hair becoming harsh. If the salt is withheld for a sufficient length of time, the mules will begin to gnaw on their mangers, fences, etc., and they begin to eat dirt.

Salt may be supplied to the mules in either the flake or the block form. It is the best practice in supplying this material to have a trough provided for the salt so that the mules may have free access to it at all times. The salt box should be protected from the weather and it should be kept free from dust and dirt.

Records have been kept of the amount of salt consumed by 20 head of mules on the Experiment Station farm for the four year period, 1924 to 1927 inclusive. During the experimental period, the mules were used for heavy farm work. Salt in the flake form was available throughout the four year period. There was a marked difference in the individual requirement for salt and there was also a marked variation in the amount of salt for the different seasons. More salt was consumed during the spring and summer periods when the mules were at heavy work than during the fall and winter periods when the work was less severe and the temperatures more comfortable. On the average the mules consumed four-tenths of an ounce of salt per 1000 pounds live weight daily. During the spring and summer the consumption ran as high as forty-six hundredths of an ounce per 1000 pounds live weight daily and this quantity decreased during the fall and winter season to an average of three-tenths of an ounce daily.

ACKNOWLEDGMENTS

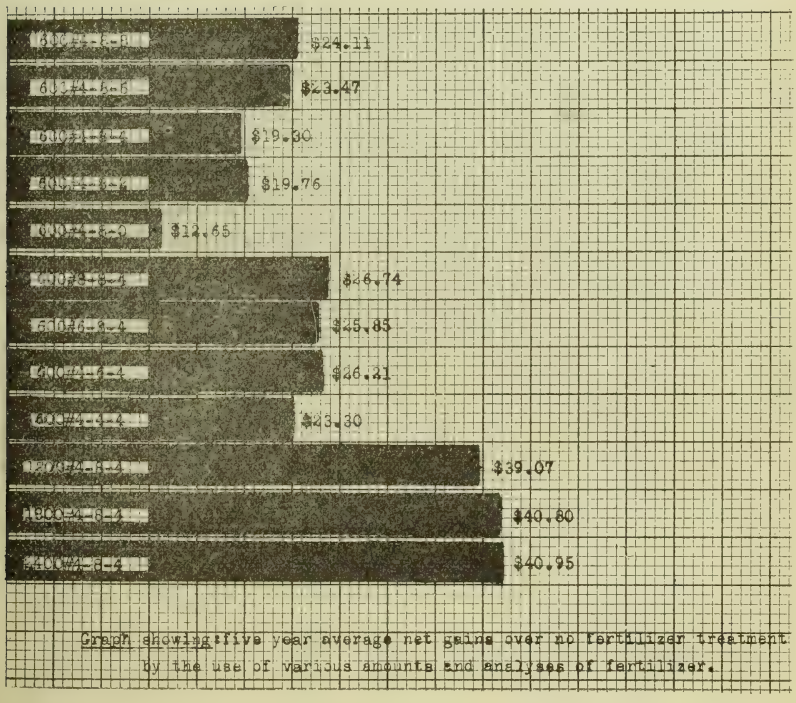
The author is indebted to Dr. W. F. Hand, State Chemist, for the analyses of all of the feeding materials used in the experiments reported in this bulletin.

Bulletin No. 271 December, 1929

REPORT OF THE RAYMOND BRANCH EXPERIMENT STATION, 1929

By

H. F. Wallace and J. L. Cooley, Jr.



Graph showing five year average net gains over no fertilizer treatment by the use of various amounts and analyses of fertilizer.

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
J. R. Ricks, Director.

REPORT OF WORK AT THE RAYMOND BRANCH EXPERIMENT STATION, 1929

By H. F. Wallace

INTRODUCTION

This report contains a summary of the work conducted on the Raymond Branch Experiment Station for the year of 1929. Many tables herein will give averages for a period of years, whereby results with various fertilizers and varieties will be more accurate. Other publications from this station may be secured upon request from the Mississippi Experiment Station, A. & M. College, Mississippi.

Experiments were expressly conducted to determine the kinds and quantities of fertilizers, varieties and cultural methods of cotton, corn, legume and truck crops best suited for the southern section of the Brown Loam soil area. Various inoculating materials for legumes have been tested and found to give about equal results. The boll weevil has been successfully poisoned and for the past two years nicotine mixtures have held the plant lice in check after applying the calcium arsenate. Beneficial results have been obtained with pruning, spraying and fertilizing fruit trees and grapes.

All fertilizer formulae used in this report will be given in the order of (N. P. K.) nitrogen, phosphoric acid and potash; that is, we have a 4-8-4 in place of our well known "8-4-4." This is in accordance with an agreement entered into with the National Fertilizer Association and northern Experiment Stations in order to put our southern Experiment Station work on the same basis with theirs. Permit us to impress that a 4-8-4 means that four per cent of the fertilizer is nitrogen in an available form, eight per cent in phosphoric acid and four per cent in potash.

As a crop year, 1929 produced more obstacles than any year that has passed since the year 1923. The early season was wet and truck crops were somewhat delayed. Winter legumes grew off slowly in the spring. Cotton lands were in many cases prepared wet or else late. Stands of cotton on the valley lands died out by the yards. The boll weevils emerged early, our cage tests showing a ten percent total emergence, and plant lice followed the first application of poison and in turn were followed by the cotton army worm on August 12th. Fair picking weather caused the crop to be harvested earlier than usual, but rain set in on October 28 and no plowing for planting the winter legumes has been done since and now the middle of December has arrived. Much corn was left in many fields on December 1st. Notwithstanding all these adverse conditions our sixteen acres of cotton plats produced over eighteen and one-half five-hundred pound bales. The corn crop on the station farm averaged about forty bushes per acre.

About 1200 visitors came to the station during the past season and when we take into consideration that Mississippi showed an increase in acre production of cotton and corn this year it leads one to believe that our farmers are using improved methods in agriculture. No doubt these annual visits to the various experiment stations are bearing their share of fruit.

Much credit is due to our capable farm manager, Mr. J. C. Peyton, for the success attained and to Mr. J. L. Cooley, Jr., Horticulturist, who rendered material assistance with the horticultural experiments. He will also report the horticultural work in this bulletin.

COTTON

Cotton represents the principal cash crop of our state and the 1929 production in Mississippi has been estimated at 1,915,000 bales; hence much attention has been given this crop from a standpoint of varieties, fertilizers, boll weevil control, spacing and disease.

As a cotton year, 1929 produced the largest crop since the year 1925. Mississippi leads all cotton states, that produced over one-half million bales, in lint production per acre. The ten year average production for Mississippi is 1,182,000 bales while this year's crop is estmated at 1,915,000 bales. The ten year average lint production per acre is 177 pounds, while it is estimated at 225 pounds for this year. Last year it was 175 pounds. For the United States, the average lint production per acre was estimated at 155 pounds for 1929.

Much difficulty was encountered in producing the crop. Many fields were plowed wet or otherwise planted late. The young plants died from "sore-shin" after being chopped and many fields were left with poor stands. The emergence of the weevil came early and was unusally heavy. Plant lice followed poisoning and in many cases the army worm followed about the middle of August, thereby, causing premature opening. Expert cotton growers of this state at this time predicted a short crop due to weevil damage and "east winds," but dry weather overcame much of this and the majority of the crop was harvested while the grade was good, earlier than usual, as ginning reports will bear out.

Below may be seen the result of twenty-five leading varieties of cotton which were planted on both valley and hill land, as shown in table 1 for the valley land test and table 2 for the hill land test.

Table 1—Cotton Variety Test—Valley Land—1929

Variety:	Lint data: Lbs. lint per acre	Lint data: Lint percentage	Lint data: Staple length	Cents value per lb.	Total value per acre	Rank
Miller-589	929.1	33.9	1 3-32	19.35	216.02	2
Stoneville-2	894.0	32.5	1 5-32	19.95	215.49	3
Lone Star-561	890.7	34.3	1 1-8	19.70	209.60	4
Half & Half	885.4	38.2	29-32	17.60	184.49	17
Lone Star-284	854.7	32.4	1 1-8	19.70	204.23	6
Miller-3286	846.7	32.0	1 1-16	19.30	199.41	9

Table 1 (Cont.)—Cotton Variety Test—Valley Land—1929

Variety:	Lint data: Lbs. lint per acre	Lint data: Lint percentage	Lint data: Staple length	Cents value per lb.	Total value per acre	Rank
Cook-1010	845.6	37.5	29-32	17.60	176.62	21
Cleveland-54	839.1	33.3	1 1-16	19.30	195.56	13
D. & P. L. No. 8	828.6	34.5	1 3-32	19.35	191.81	15
Lone Star-65	826.2	31.9	1 1-8	19.70	198.04	11
Stoneville-1	824.9	32.2	1 5-32	19.95	199.32	10
Express-121	824.9	32.2	1 1-8	19.70	197.26	12
Delfos-911	822.3	30.0	1 1-4	23.25	229.56	1
Missdel-2	816.3	31.9	1 3-16	20.55	202.60	8
Delfos-910	815.5	29.4	1 3-16	20.55	206.76	5
Cleve.-Piedmont	803.8	31.9	1	18.70	184.65	16
Cleveland-Wilson	776.8	31.7	31-32	18.30	174.67	22
Lightning Express	767.8	30.7	1 3-16	20.55	192.46	14
Delfos-0602	763.5	29.2	1 7-32	21.75	203.10	7
Lone Star-168	752.0	32.0	1 1-8	19.70	180.10	18
D. & P. L. No. 6	744.9	32.6	1 5-32	19.95	179.42	19
Acala-37	700.6	32.2	1 3-32	19.35	165.08	24
Missdel-1	686.7	31.5	1 7-32	21.75	179.23	20
Cleveland-Coker	645.7	33.2	1 5-32	19.95	154.82	25
Deltatype-Web. No. 8	600.4	28.8	1 1-4	23.25	169.29	23

NOTE: The seed were valued at $40.00 per ton.

Table 2—Cotton Variety Test—Hill Land—1929

Variety:	Lint data: Lbs. lint per acre	Lint data: Lint percentage	Lint data: Staple length	Cents value per lb.	Total value per acre	Rank
Cook-1010	622.0	39.0	7-8	17.35	122.51	4
Cleveland-54	572.4	34.4	1	18.70	123.42	3
Stoneville-1	566.2	34.4	1 1-16	19.30	125.48	1
Lone Star-561	561.3	36.1	1 1-32	19.15	122.39	5
Cleve.-Wilson	561.1	32.4	15-16	17.85	117.72	8
Lone Star-284	555.5	34.0	1 3-32	19.35	123.67	2
Stoneville-2	549.3	34.4	1 1-16	19.30	121.74	6
Half & Half	546.6	39.7	27-32	16.50	102.65	19
Miller-589	536.9	35.7	1 1-32	19.15	117.32	9
D. & P. L. No.8	530.2	34.7	1 1-32	19.15	116.50	10
Missdel-2	521.0	34.3	1 5-32	19.95	118.91	7
Miller-3286	514.9	33.7	1 1-32	19.15	113.81	12
Cleve.-Piedmont	511.4	32.6	29-32	17.60	105.89	15
Lightning Express	499.1	32.1	1 5-32	19.95	115.42	11
Lone Star-65	489.1	33.9	1 3-32	19.35	108.96	14
D. & P. L. No. 6	483.6	34.5	1 1-8	19.70	109.06	13
Lone Star-168	467.9	33.5	1 1-16	19.30	104.27	16
Acala-37	464.4	32.5	1 1-16	19.30	104.10	17
Cleveland-Coker	458.6	33.9	1 1-32	19.15	101.25	20
Delfos-911	448.9	32.0	1 5-32	19.95	103.88	18
Express-121	448.9	33.0	1 3-32	19.35	100.52	21
Delfos-0602	411.8	30.9	1 5-32	19.95	96.00	22
Missdel-1	390.7	33.4	1 5-32	19.95	89.66	25
Delfos-910	388.7	31.1	1 5-32	19.95	90.48	24
Deltatype-Web. No. 8	378.1	30.2	1 3-16	20.55	90.80	23

NOTE: The seed were valued at $30.00 per ton.

Recommendations—For hill land, it has been found that Cleveland-54, Cleveland-Wilson, any of the Lone Star strains, Cook-1010, D. & P. L. No. 8 and Stoneville No. 1 and No. 2 are all good. Cook-1010 and Cleveland-Wilson are rather short, but turn out well at the gin. All the others are one inch and slightly longer.

For valley land, Delfos-6102 and any of its progenies, any of the Lone Star strains, the Millers, Cleveland-54, Stoneville-1 and 2, Express-121 and Missdel-2 are all good. If wilt is prevalent, then Cook-1010 or Cleveland-54 will probably give the best results. To maintain length of staple in the long staple varieties, always plant them on strong land. Many long staple varieties are planted on the poorer classes of soils and when the staple is classed the cotton buyer sometimes gets the credit for shortening the length instead of the soil, which is usually responsible. Then, too, improper gin speeds often cuts the fibers.

The valley land test has been conducted for a period of nine years, while this is the third year for the hill land test. Each test was poisoned twice for the boll weevil, August 9 and 16, 1929. The valley test was planted May 3 in five series and the hill test was planted on April 20 in four series.

Fertilizers—Of the twelve hundred visitors to the station farm this past year, at least one-thousand of them were interested in fertilizers for cotton. There is no doubt but that these visitations are bringing fruit as the lint yield per acre of our state leads the ten leading cotton growing states this year. Farmers not acquainted with the use of fertilizers with cotton are astounded when shown that about ten dollars worth of a well balanced fertilizer put under an acre of cotton will double the yield on fairly good land. Many are of the opinion that fertilizers are profitable only on poor land, and after finding out otherwise, one prominent grower who was prevailed upon to use this fertilizer last season stated that it had cost him many dollars in the past because he thought his land was too good to waste fertilizers on. Mr. P. D. Ratliff, Raymond, Mississippi, a prominent lawyer and planter and a friend of the station, sums up what fertilizers will do for you as follows: "It will work night and day, when it is raining, on Saturday afternoons and when you are asleep. It will not eat anything, will not worry you, will not break up or wear out, pack off or steal anything from you. Will not run off and leave you and will always come home in the fall and bring back the dollar you paid for it and generally brings along two, three, four or five dollars as company to put into your pocket as a profit."

In testing kinds of fertilizer it is also imperative to test quantities, so varying amounts up to 2400 pounds per acre have been used on the station. A five year average net gain with 2400 pounds per acre, after paying for the fertilizer, was $40.95 greater than the value of the yield of the unfertilized plats. At the same time the 1800 pound application produced a net gain of $40.80 per acre and the 1200 pounds of the 4-8-4 produced a net gain of $39.07 per acre, indicating a 1200

pound application to be about the most profitable limit.

In most of our fertilizer work reported in this bulletin, the increase was obtained according to the standard adopted by the American Society of Agronomy as reported in volume 16, number 1 of the Journal. The column marked "check yield" was obtained according to the above method by assuming that there is a gradual increase or decrease in fertility of the soil from one plat to another.

Below is to be found the general fertilizer test conducted on the station as listed in table 3:

Table 3—Fertilizer Analysis Test With Cotton—1929

				Pounds of seed cotton per acre			Dollars per acre		
							Increase		Value
Nitrate of soda	Super-phos.	Mur. of potash	analysis	Plot yield	Check yield	Pounds increase	value at 7c	cost of fert.	net gain
No fertilizer				852	852				
160	300	100	4-8-8	1234	817	411	29.19	9.33	19.44
160	300	75	4-8-6	1291	784	507	35.49	8.73	26.76
160	300	50	4-8-4	1287	751	536	37.52	8.13	29.39
No fertilizer				718	718				
160	300	25	4-8-2	1199	737	462	32.34	7.53	24.81
160	300	.....	4-8-0	997	756	241	16.87	6.93	9.94
320	300	50	8-8-4	1368	775	593	41.51	12.81	28.70
No fertilizer				794	794				
240	300	50	6-8-4	1352	769	583	40.81	10.47	30.34
160	225	50	4-6-4	1223	746	477	33.39	7.57	25.82
160	150	50	4-4-4	1285	723	562	39.34	7.00	32.34
No fertilizer				700	700				
320	600	100	4-8-4	1765	704	1061	74.27	16.26	58.01
480	900	150	4-8-4	1835	708	1127	78.89	24.39	54.50
640	1200	200	4-8-4	1954	712	1242	86.94	32.52	54.42
No fertilizer				718	718				

Remarks—This test was planted in three series to Lone Star-65 cotton on April 19, 1929, after having been fertilized on April 13, 1929. A good stand was secured, but was damaged to some extent by a six inch rain that fell in three hours time on the night of April 25th. At least one-half of series III of this test was completely washed away to the depth of the plow, necessitating shortening of the plats to sixty-two and one-half feet in length. Records were taken from the three inside rows on each plat to eliminate variations that might be caused from the stealing of the fertilizer by the plants on the outside rows of each plat.

A size of boll study on this test revealed the fact that it required 65 bolls to make a pound of seed cotton on the unfertilized plats, while the 1200, 1800 and 2400 pound 4-8-4 plats produced bolls requiring 63, the 4-8-8 only 54, the 4-4-4 63, the 4-6-6 was 61, the 6-8-4 and the 8-8-4 required 52 bolls to make a pound of seed cotton. It is evident that well-balanced fertilizers have a tendency to make larger bolls.

Recommendations—It would appear that the use of 600 pounds of a 6-8-4 (N. P. K.) fertilizer for general conditions will give good re-

sults. Where lespedeza has preceded cotton or where cotton tends to "rust" it is advisable to use eight per cent of potash in the formula. If the land is heavily infested with coco or Johnson grasses, then apply only half of the nitrogen before planting and use the other half as a side-dressing after chopping. Heavy red clay hill sides may not need potash in some instances, but to insure full returns from the nitrogen and the phosphorus, it is best to apply about four per cent. Always remember that fertilizers judiciously used pay as well on fertile as it does on the poor soils.

Where legumes have been previously grown and turned under, then four per cent of nitrogen in a formula should be sufficient. In following heavily fertilized truck crops of the year before with cotton, it may be safe to reduce the phosphorus and potash to one-half and reduce the nitrogen to four per cent.

Where a "show patch" is wanted, use 1000 pounds per acre of a 4-8-4 under the crop about two weeks before planting and side-dress with 200 pounds per acre with nitrate of soda or the equivalent with some other quick-acting form of nitrogen.

Factory versus Home-mixed Fertilizers—This is the second year this test has been conducted. Stock-run commercial 4-8-4 fertilizers were secured from the Jackson Fertilizer Company and the Meridian Fertilizer Factory and nitrophoska (15-30-15) a highly concentrated fertilizer, was used against home-mixed 4-8-4 goods using 16 per cent superphosphate and Rhum's phosphate of 34 per cent for the phosphoric acid, nitrate of soda for the nitrogen and muriate of potash for the potash. A new factory-mixed 4-8-4 called "plant food" and sent to us by Senator H. H. Casteel, of Canton, Mississippi, was also used in this year's test. All fertilizer was applied at the rate of 800 pounds per acre, making the nitrophoska application at the rate of 208 pounds per acre.

This test was fertilized April 17, 1929 and planted in four series May 1, 1929 to Lone Star-65 cotton. Each plat consisted of five rows 125 feet long each and records were taken from the three inside rows. Very cool weather followed planting, the temperature going as low as 40 degrees F.

Table 4—Factory versus Home-mixed Fertilizers—1929

Fertilizer used per acre 800 lbs. of a 4-8-4 or 200 lbs. of a 15-30-15	Pounds of seed cotton per acre		Increase		Rank	
	Plot yield	Check yield	1929	2 yr. average	1929	2 yr. average
No fertilizer	1163	1163				
Jackson—4-8-4	1455	1174	281	293	4	3
Home-mixed-4-8-4 (superphos)	1576	1184	392	315	1	2
Nitrophoska 15-30-15	1441	1195	246	204	6	6
No fertilizer	1205	1205				
Meridian-4-8-4	1510	1206	304	330	2	1
Home-mixed 4-8-4 (Rhum's)	1463	1207	256	211	5	5
Plant Food-Canton-4-8-4	1492	1208	284		3	
No fertilizer	1209	1209				

NOTE: The fertilizer listed as Plant Food-Canton was tested during the year 1929 only.

Nitrogen Sources—Many forms of nitrogen are being offered the farmers these days and in turn they look to the experiment station for advice as to which will give the best results. Due to this fact, quite a bit of attention has been given as to finding the best source of nitrogen to use in mixing fertilizers. One test which is listed in table 5 has been conducted for five years and a new test as listed in table 6 was conducted this season for the first time.

The old test was fertilized April 12th and planted in three series to Lone Star-65 cotton on April 18, 1929. A six inch rain that fell in three hours on the night of April 25th, washed away the third series of this test to the depth of the plow. The new test was fertilized April 23 and planted to Lone Star-168 cotton on May 1, 1929. Fair stands were secured on both tests, especially on the new test.

The results for the past year as well as the five year average in the old test, gives urea a slight lead over the calcium nitrate, with nitrate of soda closely following. The new test, and one year's results are not conclusive, puts a new nitrogen, cal-nitro, slightly in the lead, with nitrate of soda a very close second. In using some forms of nitrogen in fertilizer mixtures, extreme care should be taken not to mix up more than can be put out within eight hours as chemical reactions take place that cause changes in the mechanical condition of the fertilizer as well as the loss of nitrogen plant food to the air.

Below may be seen the tabulated results of this test:

Table 5—Nitrogen Source Test With Cotton—1929

Pounds of material applied per acre:	Pounds of seed cotton per acre: Plot yield	Check yield	1929 Increase	5 year average Increase pounds	5 year average rank
No Nitrogen	1196.0	1196.0			
Nitrate of Soda	1413.0	1217.0	196.0	258.6	3
Sulphate of Ammonia	1379.0	1238.0	141.0	220.1	5
Leunasalpeter	1441.0	1259.0	182.0	230.4	4
No Nitrogen	1279.0	1279.0			
Calcium Cynamid	1333.0	1231.0	102.0	170.3	6
Calcium Nitrate	1437.0	1184.0	253.0	279.3	2
Urea	1431.0	1137.0	294.0	282.9	1
No Nitrogen	1090.0	1090.0			

NOTE: Each carrier equivalent to 150 pounds of nitrate of soda per acre.
Leunasalpeter carries a four year average only.
All plats, including checks, were fertilized with 300 pounds of super-phosphate and 50pounds of muriate of potash per acre.

Table 6—New Nitrogen Sources Test—1929

Nitrogen sources:	Pounds of seed cotton per acre: Plot yield	Check yield	Pounds increase	Rank
Nitrate of Soda	1736	1399	337	2
No fertilizer	1134	1399	-265	
No nitrogen	1399	1399		
Calcium Nitrate	1612	1399	213	6
Nitrate of Soda	1728	1399	329	3
Sulphate of Ammonia	1528	1399	129	10
Calurea	1657	1399	258	4
Ammophos	1314	1399	-85	11
Nitrate of Soda	1590	1399	191	8
Leunasalpeter	1538	1399	139	9
Cal-Nitro	1744	1399	345	1
40% Sul. of Amm. 60% Ni. of Soda	1602	1399	203	7
Nitrate of Soda	1648	1399	249	5

NOTE: All sources were applied in an 800 pound application per acre of a 6-12-6 formula.

Phosphorus Sources—This is the first time that a phosphorus sources test has been conducted on this station. The fertilizer was applied at the rate of 508 pounds per acre on April 19, 1929 and the test was planted in seven series to Lone Star-65 cotton on May 2. One year's results are not conclusive, but superphosphate is far in the lead of Rhum's phosphate or ammophos. The Rhum's phosphate was applied on a cost basis with superphosphate. Plats consist of five rows each 125 feet long.

Below may be seen table 7 which gives the tabulated results of the test:

Table 7—Phosphorus Sources Test—1929

Phosphorus sources:	Pounds of seed cotton per acre: Plot yield	Check yield	Increase	Rank
6-12-6 (Superphosphate)	1346	1112	234	1
6-00-6 No phosphorus	1112	1112		
6-24-6 (Rhum's phosphate)	1181	1112	69	2
6-12-6 Ammophos	1161	1112	49	3
6-12-6 (Superphosphate)	1346	1112	234	1

NOTE: All plots received a 508 pound application per acre.

Potash Sources—Several forms of potash are listed on the market these days and to be able to answer questions regarding these forms or sources, a more extensive potash test has been conducted than in years past. Muriate of potash has been the leader for the past three years, but this year a new source, sulphate of potash-magnesia, led with an increase of 354.4 pounds of seed cotton per acre over the no potash plat. Sulphate of potash was second with 326.9 pounds increase per acre, indicating that magnesia produced 27.5 pounds of seed cotton per acre.

When cotton "rusts" badly it signifies a deficiency of potash plant food in the soil and an application of 100 pounds per acre of muriate or sulphate of potash or 400 pounds of 12 per cent kainit will very probably correct this condition. In our plats this year, as well as last year, those receiving potash in any form held their foliage a month longer than the checks and the no potash plats. It is evident in this case that nitrogen and phosphorus do their share in maintaining a vigorous, healthy plant, but it remains in the power of the potash to cause the plant to retain its leaves. It is our opinion that a liberal application of a well balanced fertilizer and pure seed will do more to ward off plant diseases than anything else. On old cotton lands, it would probably be advisable to use at least eight per cent of potash in a fertilizer formula.

This test was fertilized April 22 and planted in four series to Lone Star-168 cotton on May 1, 1929, on land that is suffering for want of potash. Plats consist of five rows each 125 feet long. Records are taken from the three inside rows of each plat. On June 21, there was a 42 per cent weevil infestation which one application of poison reduced to 6 per cent. Two more poison applications were applied on August 9 and 16th.

Results of this test may be seen in table 8, which is listed below:

Table 8—Potash Sources Test With Cotton—1929

Sources of potash:	800 lbs. per acre formula used:	Pounds of seed cotton per acre: Plot yield	Pounds of seed cotton per acre: Check yield	Pounds Increase	Rank
Muriate	6-12-6	1936.7	1673.2	263.5	5
No potash	6-12-0	1673.2	1673.2		
No fertilizer		1176.0	1673.2	-497.2	
Kainit	6-12-6	1902.2	1673.2	229.0	7
Muriate	6-12-6	1979.0	1673.2	305.8	3
Sulphate Pot. Magnesia	6-12-6	2027.6	1673.2	354.4	1
Sulphate of Potash	6-12-6	2000.1	1673.2	326.9	2
Manure Salt	6-12-6	1940.7	1673.2	267.5	4
Muriate	6-12-6	1934.6	1673.2	261.4	6

Cotton Spacing Work—Close spacing, along with good seed and proper fertilizing, no doubt has been responsible for increased yields in Mississippi's cotton for the past few years. The cotton grower today realizes that to get high yields, a good stand must be secured. This test was conducted to determine what space in the drill the cotton plants should be. In order to avoid all possible error, each plat was thinned by hand and each space measured. After the last picking was made the stalks were again counted on each plat in order to account for those that died from natural causes or were lost by other means. All plats were fertilized exactly alike, planted the same time and treated alike in every respect.

This test was fertilized with 800 pounds of a 6-8-4 fertilizer per acre on April 17 and planted to Lone Star-65 cotton on May 3, 1929. Applications of poison were made August 9 and 16, 1929 after the infestation had reached 100 per cent. This high infestation was permitted on account of this work being located in a poison test where late applications were being tested.

Below may be seen the results of this test in table 9:

Table 9—Cotton Spacing Test—1929

Number of stalks: Per plot	Number of stalks: Per foot	Pounds of seed cotton per acre	Five year average (1925-26-27-28 and 29): Per foot	Five year average (1925-26-27-28 and 29): Pounds of seed cotton Per acre	Rank in yield
456	.91	1443	.91	1674.9	5
819	1.64	1524	1.62	1774.4	3
1109	2,21	1534	2.19	1795.8	2
1296	2.59	1434	2.77	1736.1	4
1396	2.79	1444	3.04	1803.4	1

Recommendations—A five year average indicates two to three stalks in bunches per foot on three and one-half foot rows on valley land.

For hill land, use three foot rows and leave three to five stalks in bunches every foot. The poorer classes of soils will stand much closer spacing than the fertile soils. Quick maturing, medium sized, small leaved varieties will also stand closer spacing than the slow growing, large leaf varieties.

To insure a good stand, plant one and one-half bushels of seed on well prepared, slightly elevated rows per acre from April 10 to the 25th and then hoe and side-dress your early corn and soybeans with a good form of nitrogen. In the meantime the cotton germinates and if it should get grassy, run around it with a side-harrow. Do this twice if necessary, but permit the cotton to get some growth before chopping and the weak plants will probably die out during this time and then it will be a hard proposition for any hand to cut out many of the pretty stalks.

Bear in mind that the young cotton plants should become well established before chopping. More cotton can be made on fewer acres by the proper use of fertilizer, good varieties, practical cultural methods and close spacing as has been recommended above.

Seed Treatment for Seed-Borne Diseases of Cotton—Tests were made again this year in cooperation with the Department of Plant Pathology of the Experiment Station and the State Plant Board, the plan and treatments being furnished by Dr. L. E. Miles, Plant Pathologist, A. and M. College, Mississippi. The sale of these organic mercury disinfectants for disease control is being pushed in this territory by the Bayer Chemical Company and the Du Pont Company and to be able to answer inquiries this work was continued this year.

Below are the tabulated results in table 10:

Table 10—Seed Treatment Work—Cotton—1929

Seed Treatments:	Pounds of seed cotton per acre: Plot yield	Check yield	Pounds increase	1929 Rank	1928-29 Rank
No treatment	1535	1535			
Ceresan	1556	1543	13	11	
Iodine with Bentonite	1696	1551	145	2	1
Iodine with Kieselguhr	1574	1559	15	10	5
Iodine with Fuller's Earth	1630	1567	63	5	
Dupont K I B	1633	1575	58	7	3
Dupont K. I. C.	1631	1583	48	9	4
No treatment	1593	1593			
Dupont K I X	1652	1585	67	4	
Corona Merco	1722	1575	147	1	2
Semesan	1662	1565	97	3	
Semesan, Jr.	1617	1555	62	6	
P. M. A.	1602	1545	57	8	
No Treatment	1535	1535			

Remarks—The above test was fertilized with 800 pounds of a 6-8-4 per acre on April 17th and planted in three series to Lone Star-65

cotton seed treated with various mercurial treatments. Plats consist of five rows each 125 feet long. Records were taken of the entire plat. This test was poisoned for boll weevil August 9 and 16, 1929. Army worms defoliated this field after the first picking had been made.

The two year average puts Iodine with Bentonite in the lead with an increase of 145 pounds of seed cotton per acre for 1929, while Corona Merco increases the yield in 1929 with 147 pounds of seed cotton and ranks second for the two year average. This work seems very promising and the table is submitted above for those interested.

Boll Weevil and Plant Lice Poisoning Work—Many calls come to our office regarding the advisibility of poisoning the boll weevil late in the season. This past year something over two acres of fertile valley land was used in a test to determine the answer to this question. It was also made a plant lice control test. The entire field was fertilized with 800 pounds of a 6-8-4 per acre and divided into six sections. Three of these sections were planted to Lone Star cotton on May 3 and the other three to the same variety on June 1, 1929. We must state here that visitors marveled over this June 1 cotton.

The weevil infestation on all six plats was allowed to reach 100 per cent before any poison was applied and this happened to be August 9, 1929. The May 3 cotton was divided equally into three plats and the check or unpoisoned plat was left in the center. The June 1 cotton was handled the same way. Plat No. 1 in each case received a mixture of eight parts of calcium arsenate and one part of nicotine sulphate-arsenate at the rate of 14 pounds per acre on August 9 and also on August 16, 1929. Plat No. 2 was left as a check and not poisoned, except on August 12 with a mixture of lime and arsenate of lead to control the army worm. Plat No. 3 was poisoned with a mixture of two parts of calcium arsenate to one part of tobacco dust at the rate of 14 pounds per acre at each application on the above dates.

One year's results are not considered conclusive, but in this test after paying for the poison there is a net profit of around $16.00 per acre when the two poisoned plats are combined and figured against the check. The nicotine sulphate in either form controlled the plant lice. To be certain of plant lice control, four of the worst infested farms we could find were used as cooperative tests and in each case the plant lice were controlled. The check plats were attacked by the army worm which was put under control immediately. In our first plat we used a commercial mixture of calcium arsenate and nicotine sulphate to mix with our calcium arsenate at the rates of 1 to 8. The price of this was 18 cents per pound, while the tobacco dust used cost only 4 cents per pound, but we made the 1 to 2 mixture of it and thereby used much more.

Late poisoning certainly paid this past year, even on late planted

cotton as Table 11 will show:

Table 11—Poisoning Test With the Boll Weevil and Plant Lice—1929

Poison used:	Plot yield	Pounds seed cotton per acre	Increase
		per acre	
Calcium Arsenate with Nicotine sulphate	990.7	1556.0	355.0
None	831.9	1201.0	
Calcium Arsenate with Tobacco dust	889.9	1460.0	259.0

Cotton Following Winter Legumes—The purpose of this test is to determine how much nitrogen is stored in the soil by various winter legumes. As the table below shows, some of these plats are left bare during the winter and commercial nitrogens are applied. All plats received an 0-8-4 fertilizer and the nitrogen is added to the check plats.

The legumes were turned under April 1 and the fertilizer applied to the four series April 15, 1929 and the entire field planted to Lone Star-168 cotton on April 18, 1929. Plats consist of five rows each 125 feet long and between each plat is a blank row. Below may be seen the results of this test as listed in table 12:

Table 12—Winter Legumes and Cotton Test—1929

Legume cover crop:	Fertilizer used, 600 lbs. per acre	Yield per acre seed cotton	Rank
None	6-8-4	1420	2
Hairy Vetch	0-8-4	1133	5
Monantha Vetch	0-8-4	1 [illegible]	4
None	0-8-4	1 [illegible]	6
None	6-8-4	1 [illegible]	1
Bur Clover	0-8-4	965	8
Crimson Clover	0-8-4	942	9
Austrian Peas	0-8-4	1021	7
None	6-8-4	1267	3

CORN

Mississippi has very few farmers who make enough corn to properly feed their livestock throughout the year. If food for the home and food for the livestock were raised and then the balance of the time devoted to growing cotton, then there is no doubt but that a better price could be secured for cotton. Conditions seem to be changing however as the Agricultural Statistician for Mississippi has this to say in his report of November 12: "The production of practically all field crops in Mississippi this year were considerably better than last year and for most crops better than the five year average production."

The time has been when practically all farm accounts were secured with so many bales of cotton, but today bankers are eager to advance money to reliable parties on pure bred livestock, especially for dairying purposes. A few good cows quickly grow into a profit producing herd

and a herd of cattle call for corn and legumes for feed. Growing legumes in every row of corn should be practiced on every farm as there is no better soil builder at a cheaper price. Six or seven pounds of laredo or otootan soy beans will plant an acre when planted in the row with the corn.

On November 1, 1929, it was estimated that only one and four-tenths per cent, or 321,000 bushels, of the 1928 corn crop remained on Mississippi farms. The average yield per acre in Mississippi for 1928 was 13 bushels and this year the yield is estimated at 20.2 bushels. The ten year average is around 14 bushels. This situation makes it evident that Mississippi will have to purchase many dollars worth of corn from other states. The plan of working and hoeing early corn and soybeans while waiting for cotton to get large enough to chop would certainly help remedy this situation.

The work here at this station includes variety tests, fertilier analysis tests, nitrogen sources test and corn and soybean tests.

Below may be seen table 13 which gives the results of eighteen leading varieties of corn planted in seven series May 10, 1929. Four hundred pounds per acre of a 4-8-4 fertilizer was applied before planting and when the corn was about twenty inches high it was hoed and given a side-dressing of 200 pounds of nitrate of soda per acre. Another application like this was made just before the corn tasseled. This test was planted in three foot checks on three and one-half foot rows.

Table 13—Corn Variety Test—1929

Variety:	Yield in bushels shelled corn per acre	Percentage of grain	Rank 1929	Average yield in bushels 1922-29	Average rank 1922-29
Mosby-Station	71.5	79.0	14	38.4	7
Mosby-Delta	77.3	76.2	8	41.6	3
Mosby-D. & P. L.	75.5	77.0	10		
Mosby-Suttle	70.4	81.7	15		
Mosby-Cork	69.3	80.6	16		
Cocke's Prolific-Sta.	75.4	78.1	11	41.7	2
Cocke's Prolific-Delta	79.3	77.5	3	38.1	8
Hasting's Prolific	76.5	80.6	9	38.8	5
College-47	81.8	76.1	1		
Laguna	78.9	75.0	7	43.7	1
Mexican June	79.0	77.5	6	38.5	6
Paymaster-Neal	72.2	74.0	13	41.1	4
Paymaster-Fisher	80.3	75.7	2		
Yellow Dent-Ferguson	74.5	79.5	12		
Yellow Dent-Station	79.2	78.0	4		
Golden Dent-R. H.	69.3	79.7	16		
Large Golden Dent-Sta.	79.1	77.9	5		
Large Golden Dent-Stand.	58.4	70.6	18		

Remarks—In the above table, the 1929 results will be found in the first three columns of figures. The fourth column shows the eight

year average yield of eight varieties, while the last column shows the rank of these eight varieties for eight years. This test was planted after a crop of vetch that followed cotton last year.

The leading variety in 1929 was a new variety tested at this station, called College-47 and it produced 81.8 bushels of shelled corn per acre, which was 23.4 bushels more than the yield of the trailing variety which in turn made 38.2 bushels per acre more than Mississippi's average yield of 20.2 bushels this year. Laguna leads the test in the eight year average with 43.7 bushels which is 5.6 bushels more than the next best variety. Cocke's Prolific-Station comes second in this case.

The Mosby varieties are subject to weevil damage in this section if planted early. Cocke's Prolific, Laguna, Paymaster, Hastings and College-47 are all good varieties to grow. For late plantings use Mexican June.

Table 14—Fertilizer Anlysis Test With Corn—1929

Pounds of material applied per acre			Bushels ear corn per acre		
Nitrate soda	Super-phosphate	Muriate potash	Plot yield	Check yield	Increase
200			31.5	31.5	
200	100		32.4	33.1	-.77
200	100	50	31.5	34.8	-3.3
200		50	35.2	36.4	-1.2
200			38.0	38.0	
			26.1	37.6	-11.5
200	200		41.7	37.2	4.5
200	200	50	39.8	36.8	3.0
200			36.4	36.4	

Remarks—In this test we used 200 pounds of nitrate of soda per acre as a check, for this element of plant food is certainly essential in the successful production of corn. One plat is left unfertilized in every series and all others, except the checks, vary with the addition of phosphorus and potash.

This test was fertilized May 5 and planted in four series to Cocke's Prolific corn on May 16, 1929. Plats consist of five rows each 125 feet long. A good stand was secured. It is interesting to note that the unfertilized plats produced 11.5 bushels less than the plats receiving 200 pounds of nitrate of soda per acre. Superphosphate at the rate of 200 pounds per acre added to the nitrate of soda increased the yield 4.5 bushels per acre. Superphosphate in 100 pound applications failed to increase the yield over the plats receiving nitrate of soda alone.

For general use in fertilizing corn, a mixture of 100 pounds of superphosphate, 150 pounds of nitrate of soda, calcium nitrate or their equivalent in pounds of nitrogen and 50 pounds of muriate of potash per acre will give good results. Any form of potash may be used. Where good farming and frequent cultivation is to be done, then a

side-dressing 50 to 100 pounds of nitrate of soda per acre or its equivalent in some quick acting form of nitrogen might be profitably used. Apply the side-dressing when the corn is about twenty inches tall.

Table 15—Nitrogen Sources Test With Corn—1929

Pounds material applied per acre:	Bushels ear corn per acre: Plot yield	Bushels ear corn per acre: Check yield	Bushels Increase	Percent Increase: 1929	Percent Increase: four year average
Check	19.5	19.5			
Nitrate of Soda	37.3	21.4	15.9	73.8	71.6
Sulphate of Ammonia	33.6	23.4	10.2	43.5	37.4
Leunasalpeter	33.2	25.3	7.9	31.3	47.6
Check	27.2	27.2			
Calcium Cynamid	35.3	26.0	9.3	35.7	43.1
Calcium Nitrate	37.1	24.9	12.2	49.2	69.2
Urea	35.4	23.8	11.6	49.2	59.3
Check	22.5	22.5			

NOTE: All plots including checks received 300 pounds superphosphate and 200 pounds of kainit per acre.

Remarks—Some of the leading sources of nitrogen have been tested under corn on the station for four years. The last column of figures in table 15 represents a four year average with corn showing the percentage of increase over the check or plats fertilized with 300 pounds of superphosphate and 200 pounds of kainit per acre. All these percentages indicate that nitrogen is very necessary.

The fertilizer was applied to this test May 15 and Cocke's Prolific corn planted in three series on May 16, 1929. Good stands were secured. Plats consist of five rows each 125 feet long. Records were taken from the three inside rows.

Nitrate of soda leads the 1929 test and also four year average with 73.8 and 71.6 per cent increase over the check plats, respectively. Calcium nitrate came a close second and urea was third. Nitrogen pays better dividends with corn than any other of the fertilizers in this section.

Table 16—Corn, Soybean and Peas at Lay-by Test—1928 and 1929

Method of planting:	Bushels of ear corn per acre: Plot yield	Bushels of ear corn per acre: Check yield	Bushels Decrease due to beans & peas in corn per acre
Corn, alone	37.3	37.3	
Corn with Soybeans	32.3	39.2	-6.9
Corn with peas at lay-by	40.3	41.1	-0.8
Corn, alone	42.9	42.9	

Remarks—Many inquiries come to us as to how much reduction in

yield of corn per acre can be attributed to the growth of soybeans planted in the corn rows or by planting peas in the middles at the "lay-by" cultivation. This test has been conducted for two years and was planted in three series. In fairness to the soybeans, it must be stated that dry weather ensued after the lay-by with peas and the peas made about one fifth the growth made by the soybeans. It is our opinion that had the peas been planted with the corn, as was the case with soybeans, that the reduction in yield would have been just as great. However, it must be borne in mind that for a price of 6.9 bushels of corn per acre decrease, an entire extra crop was grown on the same land at the same time and that this crop not only is valuable in itself but improves the soil for succeeding crops. By all means, Mississippi farmers should grow soybeans in every row of corn. Harvesting soybeans in corn is best accomplished by turning livestock in the fields after the corn is harvested.

Soybeans—Every farmer in this state should grow enough soybeans to supply at least the hay needed for the livestock on the farm; for this crop has a three-fold value due to the fact that it constitutes a safe feed crop, makes hay with a high grain content and improves the soil. Stock can be carried over the winter on good soybean hay and some farmers have been known to make a crop while feeding this hay alone. Every field that begins to fall off in production should be planted to beans or peas and allowed to come back to normal.

Early corn planted to otootan or goshen soybeans may be harvested in early September and stock can be turned in on the beans which are just in the blooming stage furnishing plenty of good green feed while other pastures are short or dry. This is a plan that is especially adapted to the dairy farmer and many of our visitors who have been dairying for years seem especially pleased when shown our fields where this plan is practiced. On the other hand, these beans could be cut for hay or saved for seed after the corn is harvested.

Below may be seen the tabulated results of the soybean varieety test for comparative yields of hay and grain:

Table 17—Soybean Variety Test for Hay and Grain Yields—1929

	Hay				Grain			
					Bushels			
Variety:	Date of cutting	Tons per acre, yield	Rank 1929	Rank 1928-29	Date of cutting	per acre yield	Rank 1929	Rank '28-'29
Midwest	8-21-29	1.68	15	11	9-18-29	12.7	11	9
Laredo	9-23-29	4.10	3	3	10- 3-29	21.7	2	3
George Washington	8-26-29	2.63	10	6	9-18-29	21.6	3	4
Delta-488	9-23-29	3.58	6	9	10-14-29	19.9	4	6
Mammoth Yellow	9-23-29	3.58	6	8	10-14-29	16.6	7	2
Tokio	10- 8-29	3.07	9	10	10-26-29	27.8	1	1
Goshen Prolific	10- 8-29	3.66	4	5	10-26-29	9.7	15	11
Otootan	8-26-29	2.19	13	4	9- 6-29	17.9	6	7
Tanloxi	10- 8-29	4.32	2	1	10-26-29	14.8	9	8
Biloxi	10- 8-29	3.51	8	7	10-26-29	12.2	13	10

Table 17 (Cont.) Soybean Variety Test for Hay and Grain Yields, 1929

Variety:	Hay				Grain			
					Bushels			
	Date of cutting	Tons per acre, yield	Rank 1929	Rank 1928-29	Date of cutting	per acre yield	Rank 1929	Rank '28-'29
Loxitan	10- 8-29	4.39	1	2	10-26-29	19.1	5	5
U.S.D.A.-36906-AX10	8-26-29	2.63	10	....	9-18-29	12.7	11	....
U. S. D. A.-46687	8-26-29	2.56	12	....	9-18-29	15.9	8	....
Delta-6676	10- 8-29	3.66	4	....	10-26-29	13.6	10	....
Delta-6679	10- 8-29	1.97	14	....	10-26-29	10.1	14	....

NOTE: The last four varieties listed were tested during the year 1929 only.

Remarks—This field was fertilized with 200 pounds of a 4-8-4 per acre and planted May 11, 1929 after turning under a crop of crimson clover about two weeks before. Soybeans may be planted safely from March 25 to July 15, but the earlier the planting usually the larger the yields, as the plant has more time to develop. Maturity dates of the varieties remain more or less the same regardless of when planted, that is the otootan usually begins blooming around September 1, regardless of when planted. For other varieties, we might say that the margin of difference in the dates of maturity are not nearly so great as the magin of difference in the dates of planting.

Soybeans should be cut for hay when the top pods are well formed. This is the good dough stage which makes the hay palatible and of high digestible nutrient content. The leaves will not shed much at this time.

In saving grain, cut when one-half to three-fourths of the leaves have shed, or on the other hand, when three-fourths to four-fifths of the pods have lost their green color. Saving beans for seed, on the poorer types of soil especially, is a good practice as the bean plants will improve the soil. If soybean harvesters are to be used the plants should be permitted to fully mature. On thin land soybeans should be planted on three foot rows and fertilized with 200 pounds of superphosphate per acre. Where soybeans have never been grown before, the seed should be inoculated to get the best results from a soil improvement standpoint, as well as yields.

The above table speaks for itself. Careful study of the harvest dates and yields will be beneficial to those planning to grow this crop. Again we emphasize the importance of growing soybeans in every row of corn grown in Mississippi.

Alfalfa—In order to grow this crop, four tons of crushed limestone must be applied per acre. The first cuttings on the station are always good, but crab grass usually dominates in subsequent cuttings. A couple of acres in this crop near the barn furnishes nice winter grazing for poultry and young stock and the hay comes in well on the ration for other stock, but as a commercial proposition, alfalfa will never be successfully grown on our non-lime lands. The fertilizer

test with this crop seems to favor phosphorus and nitrogen principally.

Oats—A small variety test was conducted this past year with the following yields in pounds of sheath oats per acre: Burt 3140 pounds, Appler 3115, Fulghum 2915, Rust Proof, 2575 and Turf 2430 pounds. This test was conducted in four series and each plat was one-tenth of an acre. Planted November 28, 1928 and harvested June 4, 1929. Oats mixed with vetch will furnish good winter grazing and then make good hay. Oats fit in well on any ration due to the high protein content of the grain.

Forage Crops Hay Test—This test was conducted to determine the yields on early feed crops. Sagrain was planted generally while each one-tenth acre plat was planted in the following order with the following results in yields of tons of hay per acre: Whippoorwill peas with Sagrain 4.53, Delta-488 soybeans with sagrain 5.20, Whippoorwill peas with sagrain 4.98, Ebony soybeans with sagrain 4.88, Whippoorwill peas with sagrain 4.92 and George Washington soybeans with sagrain 3.22 tons of hay per acre. This test was harvested September 18, 1929.

HORTICULTURE

By J. L. Cooley, Jr.

This station is located on the northern edge of the world famous "Crystal Springs-Hazlehurst" trucking section; hence, the horticultural investigations have been principally with truck crops. Due to the importance of the tomato as the leading truck crop in this section it has received major attention. Variety and fertilizer tests are also conducted with English peas, snap beans, cabbage, peaches, pecans and seed source work with Irish potatoes. The station has a variety orchard of apples, pears, peaches, cherries and grows many varieties of pecans, grapes and blueberries for demonstrative purposes. These demonstrations show that these fruits and pecans can be profitably produced with proper attention given to pruning, spraying, fertilization and cultivation.

Cooperative fertilizer tests were conducted with watermelons and pecans near Raymond and with tomatoes in the Crystal Springs trucking section. The test at Crystal Springs was attacked with the tomato bacterial-spot disease (Bacterium vesicatorium). In appearance this disease is very much like the common "nail-head rust" disease. The disease was identified with the cooperation of Dr. L. E. Miles, Plant Pathologist of the State Plant Board and Experiment Station, A. and M. College, Mississippi. If seed, bought on the market, is not known to be free from the bacterial-spot, they should be treated with corrosive sublimate, 1-3000 (1 tablet in 3 pints of water) for five minutes, rinsed in clear water and dried, or still better planted before the seed are thoroughly dry.

The results of the horticultural tests are reported as follows:

(1). Tomatoes—
- (a). Variety yield and wilt test.
- (b). Fertilizer analysis test.
- (c). Potash formula test.
- (d). Nitrogen sources test, six year average.
- (e). Nitrogen sources, side-dressing and nitrate of soda rate test 1929.
- (f). Long-distance shipping test.
- (g). Cooperative fertilizer test, Crystal Springs, Miss. (Nitrogen sources, side-dressing, nitrate of soda rate and potash formula tests).

(2). English Peas—
- (a). Fertilizer analysis test.
- (b). Nitrogen sources test.
- (c). Variety test.

(3). Snap Beans—
- (a). Fertilizer analysis test.
- (b). Nitrogen sources test.
- (c). Variety test.

(4). Irish Potato Seed Source Test.

(5). Cooperative Pecan Fertilizer Test.

(6). Cooperative Watermelon Nitrate of Soda Side-Dressing Test.

Table 18—Tomato Variety Test—1927-28 and 29

Varieties	Yield in lbs per acre		Percent	Percent ripened early		Average size of shippers	Percent of wilt
	Total	Shippers	Shippers	Total	Shippers	in pounds	resistance
Globe	14918	9738	65.0	50.9	51.8	.284	88 %
Gulf States	14436	9051	66.2	51.7	55.3	.266	52
Detroit	12724	8144	63.8	47.1	55.2	.235	47
Marglobe	12696	8212	63.7	51.7	51.6	.248	82
Marvel	14769	9603	64.6	46.5	43.9	.233	83
Norton	15030	9433	62.5	43.8	40.9	.256	81
Richard's	14642	9076	61.7	49.8	51.5	.258	63
Crystal Sp. Mk.	12898	7943	65.7	53.7	56.1	.268	69
La. Red	12613	7825	61.2	50.5	51.7	.207	76
La. Pink	13328	8177	61.5	54.1	58.8	.226	82
Foster	11279	7289	62.8	45.6	44.9	.229	84
Glenpage	19942	7410	41.6	44.9	41.6	.300	....
Johnson	16241	11381	70.1	42.2	41.8	.214	....

NOTE: The Foster variety was tested during the years 1928 and 29 only.
The Glenpage and Johnson varieties were tested during 1929 only.
The wilt resistance given is for the year 1928.

Remarks—This test consisted of eleven of the most promising varieties as were tested last year with the addition of two new selections, which we named Glenpage and Johnson. The seeds were planted in the hotbed January 26. The plants were transplanted to the cold-frames February 20 and set in the field on March 20. The plants were

set two feet apart in rows 3½ feet wide, staked and trained to a single stem. The test was in two series and fertilized with a 1500 pound application of a 4-8-4 analysis. The fruit was harvested in the "green wrap" stage of ripeness.

Results—The results indicate the Marvel, Globe, Norton, Richards and Gulf States to be the leading varieties, respectively, producing the larger yields of marketable fruit. The Johnson variety gave very promising results in this year's test, producing the second largest yield of marketable fruit, though they were smaller in size than that of some of the leading varieties. The Glenpage selection produced very large fruit and a very large yield, but the fruits were too rough and ununiform in shape for a commercial variety.

The Globe and Gulf States varieties produced the average largest sized marketable fruit.

The Johnson, Crystal Springs Market, Gulf States, Marvel, Detroit and Marglobe varieties, respectively, produced the highest percentage of marketable fruit, and thus the smaller yields of cull fruit.

The results indicate the Foster, Globe, Marvel, Marglobe and Louisiana Pink varieties, respectively, to be the most resistant to the bacterial wilt disease.

Table 19—Fertilizer Analysis Test With Tomatoes. (Average for 1926-27-28 and 29)

	Yield in lbs. per acre		Percent	Percent picked early		Dollars per acre		
Analysis:	Total	Shippers	Shippers	Total	Shippers	Value at 06c	Cost of fertz.	Net profit
	(1500 pounds per acre)							
3-10-3	12841	7247	56.0	41.1	40.4	434.82	19.74	415.08
3-10-3-L	13574	8965	66.0	37.9	35.9	537.90	25.50	512.40
3-8-3	13189	8131	61.6	43.9	40.4	487.86	18.05	469.81
4- 8-4	14031	8743	62.3	46.2	40.6	524.58	21.38	503.20
5- 8-3	13381	9168	69.0	42.0	41.8	550.08	23.96	526.12
	(2000 pounds per acre)							
3-10-3	14259	9237	64.7	46.6	40.3	554.22	26.32	527.90
3-10-3L	14075	8632	61.3	41.6	38.0	517.92	34.00	483.92
3- 8-3	13781	8527	61.8	43.5	42.2	511.62	24.07	487.55
4- 8-4	11731	7119	60.6	43.8	39.3	427.14	28.51	398.63
5- 8-3	13820	9093	65.1	40.9	41.3	545.58	31.95	513.63

NOTE: The 3-10-3 analysis marked L. is a commercial mixture, while the other 3-10-3 was home-mixed.

This test was conducted to determine the most economical fertilizer analysis for producing tomatoes commercially. The test was conducted in three series. Plants of the Marglobe variety were set two feet apart in rows 3½ feet wide, staked and trained to a single stem. The plants were topped with four clusters of fruit and the fruit was harvested in the "green wrap" stage of ripeness.

The fertilizer analyses tested were as listed in the above table.

The analysis marked "3-10-3 L" was a factory product and the most of the nitrogen was derived from castor pumace. This product is used very extensively in the Crystal Springs trucking region. The nitrogen in the other analyses was derived in equal pounds from nitrate of soda, sulphate of ammonia and cottonseed meal. The phosphorus was derived from 16 per cent superphosphate and the potassium from muriate of potash.

Results—The above table represents average results of this test for a period of four years. In the 1500 pound application the 5-8-3 analysis produced the largest yield of marketable fruit and the highest net profit per acre. In the 2000 pound application the 3-10-3 analysis produced the largest yield of marketable fruit and the largest net profit. The 5-8-3 analysis ranked second in this application.

The 3-10-3 with the combination (home-mixed) nitrogen source produced the largest net profits per acre in both the 1500 and 2000 pound applications for the year 1929. The 3-10-3 L produced second best results in the 1500 pound application and fourth best results in the 2000 pound application during the year 1929. These results indicate the 5-8-3 and 3-10-3 in 1500 and 2000 pound applications per acre, respectively, to be the better analyses for producing the early commercial crop.

Table 20—Average Results of Potash Test With Tomatoes. (1924-25-26-27-28 and 29.)

	Yield in lbs. per acre		Percent	Percent picked early		Dollars per acre		
Analysis:	Total	Shippers	Shippers	Total	Shippers	Value at 06c	cost of fertz.	Net profit
(1000 pound application per acre)								
4-8-0	12715	7040	54.2	43.9	51.0	422.40	10.44	411.96
4-8-4	13708	7551	51.9	49.2	47.9	453.06	12.52	440.54
4-8-6	14539	7228	48.5	46.9	51.0	433.68	13.56	420.12
(1500 pound application per acre)								
4-8-0	14000	7466	50.9	43.5	50.9	447.96	15.66	432.30
4-8-4	13042	7167	52.7	48.4	47.1	430.02	18.78	411.24
4-8-6	13358	7688	56.1	45.0	47.4	461.28	20.34	440.94
(2000 pound application per acre)								
4-8-0	13282	7120	50.9	42.5	41.4	427.20	20.88	406.32
4-8-4	14103	7926	51.5	45.8	50.3	475.56	25.04	450.52
4-8-6	12471	6605	53.0	37.3	37.3	396.30	27.12	369.18

This test was conducted to determine the most economical amount of potash to use in a fertilizer formula for producing tomatoes commercially. Plants of the Globe variety were set two feet apart in rows 3½ feet wide, staked and trained to a single stem. The plants were topped with four clusters of fruit and harvested in the "green wrap" stage of ripeness. This test was conducted in three series. The potassium was derived from muriate of potash and the phosphorus from 16 per cent superphosphate. The nitrogen was a combination source as given in the preceding test.

Results—The above table of results represent an average over a period of six years and should be very dependable. In the 1000 and 2000 pound applications the 4-8-4 formula gave the highest net profits per acre. This formula also produced the highest net profits in all applications during the year 1929. In the 1500 pound application for the six year period the formula carrying 6 per cent potash produced a small net profit greater than produced by the 4-8-4 and 4-8-0 analyses. It is our opinion that the potash percentage in the fertilizer formula should be varied according to the type of soil used, the sandy soils requiring the more potash. We feel safe in recommending 4 per cent of potash in a formula on average soils used for tomatoes, believing this will enable the plants to make better use of the nitrogen and phosphorus plant foods. From observations a more stockily built plant and better colored fruit results from the use of potash in a tomato fertilizer.

Table 21—Average Results of Nitrogen Source Test With Tomatoes. (1924-25-26-27-28 and 29)

Nitrogen sources:	Yield in lbs. per acre		Percent	Percent picked early		Total value,	
	Total	Shippers	shippers	Total	Shippers	dollars	Rank
(1500 pound application of a 4-8-3 per acre)							
Nitrate of Soda	11435	6463	54.1	45.0	50.8	388.78	2
Ammonium Sulphate	10318	5699	52.9	52.0	52.1	341.94	4
Combination	11106	6556	55.6	47.3	47.7	393.36	1
Cottonseed Meal	11141	6383	54.9	46.0	45.3	382.98	3
Urea	9671	5421	53.8	47.7	51.6	307.26	5
(2000 pound application of a 4-8-3 per acre)							
Nitrate of Soda	11286	6417	54.6	47.3	50.1	385.02	3
Amm. Sulphate	11192	6206	54.1	51.5	53.1	372.36	4
Combination	12045	6489	52.5	47.5	51.0	389.34	2
Cottonseed Meal	11814	6878	55.8	46.2	48.8	412.68	1
Urea	10966	6065	54.2	50.4	54.1	363.90	5

NOTE: The Urea source was not tested during the year 1929.

Remarks—This test was conducted to determine the best source of nitrogen to use in a complete fertilizer formula for producing tomatoes commercially. Plants were used of the Globe variety, set two feet apart in 3½ foot rows, staked and trained to a single stem. Plants were topped with four clusters of fruit. The fruit was harvested in the "green wrap" stage of ripeness. Where a combination source is listed the nitrogen was derived in equal pounds from nitrate of soda, sulphate of ammonia and cottonseed meal. The other sources used were as listed. The phosphorus was derived from 16 per cent superphosphate and the potassium from muriate of potash.

Results—The above table represents average results of this test for a period of six years. The results indicate the combination, nitrate of soda and cottonseed meal to be the three leading sources. Urea has also given very good results for a period of five years. The high

cost of the nitrogen in the cottonseed meal source prohibits its use on a commercial basis.

In the 1500 pound application the combination, cottonseed meal and nitrate of soda are the three leading sources, respectively. In the 2000 pound application cottonseed meal, the combination and nitrate of soda, respectively, are the three leading sources. There appears to be no definite relation between the source used and the percentage of marketable fruit produced. Neither does the source used appear to have any marked influence on earliness.

Table 22—Nitrogen Sources, Nitrate of Soda Rate, and Nitrogen Source and Side-dressing Test—1929

	Pounds per acre		Per-cent	Percent picked early		Dollars per acre			Aver
						Total value @ 6c	Cost		
Nitrogen Sources:	Total	Ship-pers	Ship-pers	Total	Ship-pers	per pound	of fertz.	Net profit	of fr per
(Nitrogen Sources Test in a 1500 pound application of a 4-8-4 analysis)									
Nitrate of Soda	17279	10411	60.2	42.2	40.8	624.66	20.64	604.02	.2
Ammonium Sulphate	16024	10661	66.5	49.4	44.8	639.66	19.08	620.58	.2
Cottonseed Meal	16698	11126	66.6	44.1	41.0	667.56	31.44	636.12	.2
Combination	17183	11134	64.8	41.9	38.4	668.04	23.60	644.44	.2
½ Ni. of Soda & ½ C. S. Meal	17162	11234	65.4	42.9	38.8	674.04	25.86	648.18	.2
½ Amm. Sul. & ½ C. S. Meal	17766	11356	63.9	45.4	41.0	681.36	25.26	656.10	.2
Calcium Nitrate	16230	11089	68.3	38.6	35.8	665.34	20.64	644.70	.2
Calurea	16423	11084	67.5	39.4	35.9	665.04	16.68	648.36	.2
(Nitrogen Sources Test in a 2000 pound application of a 4-8-4 analysis)									
Nitrate of Soda	15849	10293	64.9	41.0	36.5	617.58	27.52	591.86	.2
Ammonium Sulphate	16259	9898	60.9	43.7	39.3	593.88	25.44	568.44	.2
Cottonseed Meal	17346	11970	69.0	40.2	38.0	718.20	41.92	676.28	.2
Combination	16816	10797	64.2	42.1	38.6	647.82	31.87	616.35	.2
½ Ni. of Soda & ½ C. S. Meal	15847	10328	65.2	39.4	39.2	618.68	34.48	585.20	.2
½ Amm. Sul. & ½ C. S. Meal	17062	10900	63.9	37.9	36.2	654.00	33.68	620.32	.2
Calcium Nitrate	17536	11947	68.1	37.1	33.6	716.82	27.52	689.30	.2
Calurea	16501	10564	64.0	41.1	37.9	633.84	22.24	611.60	.2
(Nitrate of Soda Rate Test in a 4-8-4 analysis)									
1000 pounds per acre	13449	7064	52.5	32.9	37.2	423.84	13.76	410.08	.2
2500 pounds per acre	15648	10004	64.0	28.0	30.2	600.24	34.40	565.84	.2
3000 pounds per acre	14530	8765	60.3	35.7	39.9	525.90	41.28	484.62	.2
(Nitrogen Source and Side-dressing Test in a 1000 pound per acre application)									
Nitrate of Soda, side-dressed with 200 lbs of Ni. Soda	12924	7410	57.3	38.1	39.0	444.60	18.74	425.86	.3
½ Ni. Soda & ½ C. S. Meal, side-d. with 200 lbs of Ni. Soda	13680	8052	58.8	40.4	42.8	483.12	22.34	460.78	.3
½ Amm. Sul. & ½ C. S. Meal, with 150 lbs of Amm. Sul.	12558	7348	58.5	36.2	37.6	440.88	21.04	419.84	.3
C. S. Meal, side-dressed with 200 lbs of Ni. Soda	14676	8533	58.1	35.9	41.5	511.98	25.94	486.04	.3

Remarks—This test was conducted to determine the most economical nitrogen source and side-dressings and rate of applications of nitrate of soda in a 4-8-4 analysis, as conducted during the years 1927 and 1928 with the exceptation that calurea was substituted for urea

and calcium nitrate was added to the test. The source test was conducted in both 1500 and 2000 pound per acre applications. The source and side-dressing test was conducted in a 1000 pound application of the formula sources in a 4-8-4 analysis and side-dressed with 200 pounds per acre of nitrate of soda and 150 pounds of sulphate of ammonia as listed in the above table. All plants were of the Marglobe variety, set two feet apart in rows 3½ feet wide, staked and trained to a single stem. Plants were topped with four clusters of fruit. The fruit was harvested in the "green wrap" stage of ripeness, graded according to U. S. Standard grades and marketed at six cents per pound.

Results—In the 1500 pound application the sources composed of equal pounds of nitrogen from sulphate of ammonia and cottonseed meal, from equal pounds of nitrogen from nitrate of soda and cottonseed meal and the urea source were the three leeading sources, respectively.

In th 2000 pound application the colcium nitrate and cottonseed meal sources produced the leading results, respectively.

In the rate of application test with nitrate of soda, the 2500 pound rate produced much better results than any other rate, producing 10004 pounds per acre of markeable fruit that averaged .264 pounds each in weight, 64 per cent of marketable fruit and a net profit of $565.84 per acre. The 3000 pound rate gave better results than the 1000 pound per acre application.

In the nitrogen source and side-dressing test the cottonseed meal formula source when side-dressed with 200 pounds per acre of nitrate of soda was the leading combination, producing a net profit per acre of $486.04 above the cost of the fertilizer. The formula source composed of equal pounds of nitrogen from nitrate of soda and cottonseed meal when side-dressed with 200 pounds of nitrate of soda per acre produced second best results. In every case the nitrate of soda side-dressings produced larger average sized fruit than the sulphate of ammonia side-dressing.

Tomato Long-distance Shipping Test—1929—This test was conducted to determine the influence different rates of applications of nitrate of soda in a 4-8-4 fertilizer formula and various amounts of potash in a fertilizer formula on the shipping and keeping quality of tomatoes. Shipments of fruit (varying from one basket to four baskets) from the Experiment Station and cooperative plots were made by local express to the Bureau of Agricultural Economics, U. S. D. A., New York City for a careful and rigid inspection. The crates were marked representative numbers so that the government inspectors could not know any details of the test and that an unbiased report could be obtained.

Results—These reports give the following information:

Fertilizer rates per acre	Analysis	Per cent of marketable fruit		
		On arrival	5 days later	10 days later
(Station Plots, shipping results)				
1000 lbs. Nitrate of Soda	4-8-4	100.0	100.0	91.5
2000 lbs. Nitrate of soda	4-8-4	100.0	91.1	91.6
2500 lbs. Nitrate of soda	4-8-4	100.0	100.0	96.7
3000 lbs. Nitrate of soda	4-8-4	100.0	98.4	88.3
(Crystal Springs cooperative plots, shipping results)				
1000 lbs. Nitrate of soda	4-8-4	100.0	100.0	100.0
2500 lbs. Nitrate of soda	4-8-4	100.0	100.0	98.2
3000 lbs. Nitrate of soda	4-8-4	100.0	100.0	100.0
1500 lbs. potash test	4-8-0	100.0	100.0	88.8
1500 lbs. potash test	4-8-4	100.0	100.0	88.9
1500 lbs. potash test	4-8-8	100.0	100.0	100.0
1500 lbs potash test	3-10-3	100.0	100.0	70.8

All crates arrived with a tight pack and in good condition. No fruit cracks and puffy fruit were reported. It is evident that these fruits were subjected to a more severe treatment than would have been the case had they been in car-lot shipments, under these conditions no crate scars were reported. These results indicate that the fruit from all fertilizer treatments shipped well and kept firm in a marketable condition for the first five day period of the test; but, as shown in the above table some of the fruit failed to keep in such a good marketable condition from the five to ten day period while in storage.

Table 23—Results of Cooperative Tomato Fertilizer Test—1929
(In Cooperation With Mr. Carl Taylor, Crystal Springs, Miss.)

rogen nula rces:	Side-dressings:	Pounds per acre Total	Shippers	per-cent ship-pers	Per cent picked early Total	ship-pers	Dollars per acre: Total value @ 6c per pound	Cost of fertz.	Net prof-it	Aver-age size per pound
	(1500 pound application per acre of a 4-8-4)									
rate of soda	Nitrate of soda	7242	4694	64.8	73.4	78.9	281.64	25.62	256.02	.184
cium nitrate	Calcium nitrate	6102	4075	66.7	81.4	81.9	244.50	25.62	218.88	.175
nbination	Nitrate of soda	6312	39.52	62.6	76.4	81.9	237.12	29.78	207.34	.188
nbination	Ni. So. & M. potash	6407	4202	65.6	75.8	83.3	252.18	28.67	223.51	.191
rate of soda	Manganese sulp.	6131	4017	65.5	68.5	74.5	241.02	27.05	213.97	.181
grower 3-10-3	None	5541	3558	64.2	73.4	78.3	213.48	25.50	187.98	.169
grower 3-10-3	Nitrate of soda	6719	4196	62.4	78.1	81.4	251.76	30.50	221.26	.195
	(Nitrogen source test with no side-dressing—1500 lbs. per acre of a 4-8-4)									
te of soda		6583	4551	69.1	70.5	75.4	273.06	20.64	252.42	.182
um nitrate		6430	4236	65.8	68.2	72.9	254.16	20.64	233.52	.178
bination		6502	3839	59.2	74.3	78.5	230.34	24.80	205.54	.184
	(Nitrate of soda rate test in a 4-8-4 formula)									
0 pounds per acre		6009	3915	65.1	73.9	80.9	234.90	13.76	221.14	.191
0 pounds per acre		8266	5489	66.4	73.7	79.5	329.34	34.40	294.94	.197
0 pounds per acre		7670	5422	70.6	73.7	78.4	325.32	41.28	284.04	.225
	(Potash formula test)									
)		5988	3910	65.1	75.6	79.1	234.60	17.88	216.72	.191
4		6305	4296	68.1	67.1	74.7	257.76	20.64	237.12	.184
8		6375	4265	66.9	77.3	81.7	255.90	23.40	232.50	.185

E: All nitrate of soda side-dressings were at the rate of 200 pounds per acre, with the exception when used with muriate of potash and in this case 100 pounds of muriate of potash and 100 pounds of nitrate of soda were used together. Where manganese sulphate is listed in the above table, 50 pounds per acre were used.

This test was conducted in the Crystal Springs sectoin in cooperation with Mr. Carl Taylor. The plots were located about one mile north of town on the Jackson Highway. The Chilean Nitrate Educational Bureau, Jackson, Mississippi, and the Educational Bureau of the N. V. Potash My., Jackson ,Mississippi, also cooperated in this test. This test was conducted in three series. The nitrogen sources test consisted of nitrate of soda, calcium nitrate and the combination source (as given in the preceding tests). In the nitrogen source and side-dressing test seven sources were tested with side-dressings of nitrate of soda, calcium nitrate, nitrate of soda and muriate of potash, and manganese sulphate as listed in the above table. Manganse sulphate is a plant food element not now being used in this state with the tomato crop, but its use has been very profitable in some tomato sections in Florida. The 3-10-3 analysis is the factory product commonly termed "vegetable grower" in the Crystal Springs trucking region and is used very extensively with the tomato crop in that section. In the nitrate of soda rate test the 1000, 2500 and 3000 pound per acre rate of applications are tested in a 4-8-4 analysis. In the potash test the 4-8-0, 4-8-4 and 4-8-8 analyses are tested.

All plots were planted to the same variety and received the same cultural treatments. The fruit was harvested in the "green wrap" stage of ripeness. This test was attacked with the bacterial-spot disease (bacterium vesicatorium), which resembles the common nail-head rust disease very much. It is estimated that the crop production was damaged about 25 per cent. For the control of these two diseases write to the Mississippi State Plant Board, A. and M. College, Mississippi, for information.

Results—In the nitrogen sources test nitrate of soda produced the largest yield of marketable fruit and a net profit of $252.42 per acre, while the calcium nitrate and combination sources produced net profits of $233.52 and 205.54, respectively.

In the nitrate of soda rate test the 2500 pound application gave the leading results, producing a net profit of $294.95 per acre. The 3000 pound application produced the second largest net profit and, outstandingly, the average largest sized fruit.

In the nitrogen source and side-dressing test nitrate of soda as the formula source and side-derssed with 200 pounds per acre of nitrate of soda produced the largest net profit per acre. The combination source side-dressed with 100 pounds of nitrate of soda and 100 pounds of muriate of potash per acre produced second best results. The 3-10-3 analysis side-dressed with 200 pounds of nitrate of soda per acre produced the average largest fruit and $33.28 more profit per acre than when the 3-10-3 received no side-dressing with nitrate of soda. The combination source side-dressed with 50 pounds of manganese sulphate per acre produced 178 pounds of marketable fruit with a net profit of $5.43 per acre more than the same source with no side-dressing.

In the potash formula test the 4-8-4 produced a larger net profit than the 4-8-0 and 4-8-8 analyses and a higher percentage of marketable fruit. This indicates that 4 per cent of potash is needed in tomato fertilizers in this section and is more profitable than even 8 per cent.

Table 24—Average Results of Fertilizer Analysis Test With English Peas (1924-25-26-27-28 and 29.)

Analysis:	Yield per acre in pounds	Dollars per acre			6 yr. average rank	1929 rank
		Value at 5c	Cost of fertilizer	Net profit		
		(1000 pound application per acre)				
3-10-3	3245	162.25	11.59	150.66	1	1
4- 8-4	2955	147.75	12.52	135.28	2	2
6- 8-4	529	26.45	16.80	9.65		4
4- 8-0	552	27.60	10.44	17.16		3
		(1500 pound application per acre)				
3-10-3	3084	154.20	17.39	136.81	1	4
4- 8-4	3023	151.15	18.78	132.37	2	3
6- 8-4	493	24.65	25.20	-.55		2
4- 8-0	497	24.85	15.66	9.19		1

NOTE: The analyses 6-8-4 and 4-8-0 were tested during the year 1929 only.

Remarks—This test was conducted to determine the most economical fertilizer analysis for producing the commercial pea crop. The test was planted to the Thomas Laxton variety and in four series. Excessive rains immediately after planting prevented proper germination of the seeds and the test had to be planted the second time. Due to the lateness of the crop, the yields were not as large as normally. The nitrogen in these analyses was derived in equal pounds from nitrate of soda, sulphate of ammonia and cottonseed meal. The phosphorus was derived from 16 per cent superphosphate and the potassium from muriate of potash. The 6-8-4 and 4-8-0 analyses were tested during the year 1929 only.

Results—The above table represents results for a period of six years with the exception of the 6-8-4 and the 4-8-0 analyses. The 3-10-3 analysis produced larger net profits per acre than the 4-8-4 in both the 1000 and 1500 pound applications. During the year 1929 the 1000 pound application of the 3-10-3 analysis and the 1500 pound application of the 6-8-4, respectively, produced the largest net profits per acre.

Table 25—Average Results of Nitrogen Sources Test With English Peas—(1924-25-26-27-28 and 29.)

Nitrogen sources:	Yield per acre in pounds	6 year average rank	1929 rank
Nitrate of Soda	3672	1	3
Ammonium Sulphate	3649	2	4
Combination	2919	3	2
Leunasalpeter	569		1
(1500 pounds per acre of a 4-8-4)			
Nitrate of Soda	3525	1	3
Ammonium Sulphate	3437	2	4
Combination	3131	3	1
Leunasalpeter	615		2

NOTE: The Leunasalpeter source was tested during the year 1929 only.

This test was conducted to determine the most economical source of nitrogen for producing the commercial crop. It was conducted in four series and planted to the Thomas Laxton variety. The sources used were as stated in the above table. Leunasalpeter was tested during the year 1929 only. The combination source was derived in equal pounds from nitrate of soda, sulphate of ammonia and cottonseed meal. The phosphorus was derived from 16 per cent superphosphate and the potassium from muriate of potash. All sources were tested in 1000 and 1500 pound applications of a 4-8-4 formula.

Results—The nitrate of soda source has been the leading source for a period of six years, yielding an average of 3672 pounds in the 1000 pound application and 3525 pounds per acre in the 1500 pound application of marketable peas. The sulphate of ammonia and combination sources, respectively, have produced the second and third largest yields in both applications.

For the year 1929 leunasalpeter produced first and second best

results in the 1000 and 1500 pound applications, respectively. The combination source gave the best results in the 1500 pound application, while nitrate of soda gave third best results in both applications.

English Pea Variety Test—The variety test for the year 1929 consisted of the Thomas Laxton, World's Record, Blue Bird and Sutton's Ideal varieties. The test was conducted in two series, using a 1000 pound application per acre of a 3-10-3 analysis. This test was planted the second time as given for the analysis test and due to the late and warm growing season, light yields resulted. The World's Record, Thomas Laxton and Sutton's Ideal varieties produced the largest yields, respectively. The Sutton's Ideal variety was tested for the first time this year and appears to be a very good variety. It is planted with much success in this trucking section. The Thomas Laxton and World's Record varieties are grown extensively on a commercial scale.

Table 26—Average Results of Fertilizer Analysis Test With Snap Beans (1924-25-26-27-28 and 29)

Analysis:	Yield per acre in pounds	Dollars per acre: Value at 5c	Cost of fertilizer	Net profit	6 yr. average rank	1929 rank
		(1000 pound application per acre)				
3-10-3	3792	189.60	11.59	178.01	1	4
4- 8-4	3624	181.20	12.52	168.68	2	3
6- 8-4	4907	245.35	16.80	228.55		1
4- 8-0	4503	225.15	10.44	214.71		2
		(1500 pound application per acre)				
3-10-3	4241	212.05	17.39	194.66	2	4
4- 8-4	4309	215.45	18.78	196.67	1	3
6- 8-4	6739	336.95	25.20	311.75		1
4- 8-0	5933	296.65	15.66	280.99		2

NOTE: The analyses 6-8-4 and 4-8-0 were tested during the year 1929 only.

Remarks—This test was conducted to determine the most economical fertilizer analysis for producing the commercial crop of snap beans. It was planted to the Giant Stringless green pod variety and in three series. The 6-8-4 and 4-8-0 analyses were tested during the year 1929 only. The bacterial blight disease as mentioned with the variety work also attacked this test, though the harvest was most done and the production was not affected.

Results—The above table represents average results for a six year period with the 3-10-3 and 4-8-4 analyses and for the year 1929 with the 6-8-4 and 4-8-0 analyses. For the six year period the 3-10-3 produced a larger yield of marketable beans and a greater net profit above the cost of the fertilizer than the 4-8-4 analysis in the 1000 pound application. In the 1500 pound application the 4-8-4 produced better results than the 3-10-3 analysis.

For the year 1929, the 6-8-4 analysis produced better results than the other analyses. This indicates that the bean crop demands more nitrogen than the 3-10-3 and 4-8-4 analyses provide. From the results

of this test we feel safe in recommending a 1000 pound application of the 3-10-3 analysis.

Table 27—Average Results of Nitrogen Sources Test With Snap Beans (1924-25-26-27-28 and 29)

Nitrogen sources:	Yield per acre in pounds	6 year average rank	1929 rank
(1000 pound application per acre of a 4-8-4)			
Nitrate of Soda	3941	1	1
Ammonium Sulphate	3926	2	3
Combination	3688	3	4
Calurea	4802		2
(1500 pound application per acre of a 4-8-4			
Nitrate of Soda	4166	1	1
Ammonium Sulphate	3849	3	4
Combination	3942	2	3
Calurea	4812		2

NOTE: The Calurea source was tested during the year 1929 only.

Remarks—This test was conducted to determine the most economical source of nitrogen for producing the commercial crop and was in four series. The sources were tested in a 1000 pound per acre application of a 4-8-4 formula. The Calurea source was tested only during the year 1929. The combination source was derived in equal pounds of nitrogen from nitrate of soda, sulphate of ammonia and cottonseed meal. The phosphorus was derived from 16 per cent superphosphate and the potassium from muriate of potash. The test was planted to the Valentine variety.

Results—Nitrate of soda has been the leading source on an average for a period of six years, yielding 3941 pounds per acre in the 1000 pound application and 4166 pounds per acre in the 1500 pound application. The combination source produced the second largest yield in the 1500 pound application and the sulphate of ammonia source produced the second largest yield in the 1000 pound application.

For the year 1929 the nitrate of soda source produced the largest yields in both the 1000 and 1500 pound applications and the Calurea source produced second best results in both applications.

Snap Bean Variety Test—This test consisted of the Valentine, Flagolet, Yellow Wax and the Giant Stringless Green Pod varieties. The test was fertilized with a 1000 pound application of a 4-8-4 fertilizer and conducted in two series. The bacterial blight disease attacked these plots and practically destroyed the Valentine variety. The other varieties were practically unaffected. The Giant Stringless variety produced the largest yield per acre, yielding 4825 pounds. The Wax variety produced 3714 pounds, Flagolet 1240 and the Valentine only 457 pounds per acre. The Giant Stringless, Yellow Wax and Valentine are three of the leading varieties grown in this trucking section.

Table 28—Irish Potato Seed Source Test—1929

Variety sources:	Yield in pounds per acre		
	Total	Marketable	Culls
Triumph-Certified	11.182	9,872	1,310
Triumph-Uncertified	10,773	9,527	1,246
Cobbler-Certified	12,014	11,068	946
Cobbler-Uncertified	11,671	9,362	2,309

NOTE: The certified sources were furnished by the Agricultural agent of the Illinois Central Railroad Company, while the uncertified sources were secured from local merchants.

Remarks—This test was conducted in cooperation with Mr. J. O. Tackett of the agricultural division of the Illinois Central Railroad Company, Jackson, Mississippi. He furnished the certified seed, while the uncertified seed were obtained from local grocerymen. The test was fertilized with 1000 pounds per acre of a 4-8-4 fertilizer and planted March 29. Each plot received exactly the same fertilization and cultivation.

As given in the above table the certified triumph produced a yield of 345 pounds per acre more than the uncertified triumph seed. The certified Cobbler produced 1,706 pounds per acre more than the uncertified Cobbler and 2,363 pounds per acre less cull potatoes than the uncertified seed. Most of the cull potatoes from the uncertified seed were due to the occurence of the potato scab disease, which occurred very little on the potatoes produced by the certified seed.

During the past four years 1925-28 this station cooperated with the other Experiment Stations of the state and the State Plant Board in conducting a very extensive test similar to the above. Largely due to the results of these tests, the use of certified seed by Mississippi growers has been increased from a few bushels in 1925 to approximately 20,000 bushels in 1928. An average of the four years' results from these cooperative tests may be obtained in circular form (Circular No. 80) from the Mississippi Experiment Station, A. and M. College, Mississippi. An extract from this circular is given below:

"In each test conducted the certified have proven superior to the uncertified seed. This has been the case especially with the Triumph variety because it is more susceptible to the mosaic disease than the Cobbler variety. The average yield per acre of marketable potatoes of 52 samples of certified Triumph seed was 120.2 bushels as compared to an average yield per acre of 84.2 bushels for 21 samples of uncertified seed of the same variety, or an increase of 42.8 per cent. The average yield per acre of marketable potatoes of 28 samples of certified Cobbler seed was 163.8 bushels as compared to an average yield of 128.2 bushels for 7 samples of uncertified seed of the same variety, or an increase of 27.7 per cent."

"The results from these tests prove that certified seed are much superior to uncertified seed. They also indicate that there is a difference in the quality of certified seed produced by individual growers

within a state. Therefore too much stress can not be placed upon the value of keeping the tags which give the name or certificate number of the grower and which accompany each sack of certified seed."

Nitrate of Soda Side-dressing Test With Watermelons

Remarks—This test was conducted to determine the effect of side-dressing with nitrate of soda on the yield, quality and size produced. This test was in cooperation with Mr. Ira Chapman, one of the largest producers of melons in this section of the state. All melon plants were of the same variety and age. The seeds were planted ten feet apart in rows ten feet wide. Each plot received a 1500 pound application per acre of a 3-10-3 fertilizer one week previous to the planting of the seeds. The test was conducted in two series, each plot being 1-17.4 of an acre and consisting of twenty-five hills. The plants were side-dressed with nitrate of soda when the vines were five feet long and had but few blooms developed. The rates used were 100, 200, 300 and 400 pounds per acre.

Results—No fruit cracks developed even from the heavy applications and the melons were of good quality. Some of the melons had a hard white streak in the center which was attributed to the excessive rainy season, as melons on adjoining rows that received no side-dressing but were fertilized with the 1500 pound application of the 3-10-3 had the same hard white streaks. The melons produced by the 100, 200, 300 and 400 pound rates, respectively, averaged 26, 22, 24 and 26 pounds in weight each. The 100, 200, 300 and 400 pound rates produced, respectively, 15259, 19604, 20836 and 23461 pounds yield per acre. These results indicate very little relation between the rate of the side-dressing and the average size of the melons produced; but, there is a marked relation between the rate of the side-dressings and the yields per acre produced.

Fertilizer Work With Pecans

Remarks—This test was conducted in cooperation with Mr. Ney Williams, Raymond, Miss. There were 30 trees of the same age and variety. One-third of the trees were fertilized with three pounds per tree of the complete nitrophoska fertilizer. One-third were fertilized with three and eight-tenths pounds per tree of nitrate of soda, while one-third received no fertilizer as check plots. The fertilizer was applied and worked into the soil during the winter of the year 1928. Circumference measurements were made of each tree and again made the following winter to determine the growth produced by the different treatments.

Results—The trees fertilized with the complete fertilizer measured an average of 5.13 inches in circumference at the beginning of the test and made an annual growth increase of 1.28 inches.

The trees fertilized with nitrate of soda measured an average of 5.85 inches in circumference at the beginning of the test and made an annual growth increase of 1.23 inches.

The trees in the check plot which received no fertilizer measured an average of 5.83 inches in circumference at the beginning of the test and made an annual growth increase of 1.13 inches.

GENERAL WORK

By H. F. Wallace

Rotations—Every farmer in the state should practice crop rotation. It is our policy to grow a legume on all lands at least once a year. The poorer fields and all corn lands grow legumes twice a year. Most of our lands on the station at present are growing winter legumes of some kind, either alone or planted with oats or rye. Several rotations are under way and outstanding among these is the two year rotation with cotton, vetch and rye or oats, corn and soybeans. This means that two crops are grown on the land every year and one of these crops is a soil builder the first year and the second year two soil builders are grown, one in the winter and the other with the corn in the summer.

To begin this rotation sow broadcast seventeen to twenty pounds of inoculated hairy vetch seed at the last cultivation of the cotton. Rye or oats may be mixed with the vetch seeds. This statement is not made for those who "lay-by" cotton by July 4, but for the real cotton farmer that cultivates up to the time cotton is nearly ready to open. This vetch or vetch with rye or oats will germinate in the fall and mature seed around the first of June when the entire crop should be turned under to insure a volunteer crop the following fall. After turning under, plant the land to corn and soybeans. As stated, the vetch volunteers and in the spring may be turned under or cut for hay as desired and then the land planted to cotton. It is advisable to turn the vetch under as the green crop is very valuable in nitrogen content. Permit vetch to mature seed every other year and be insured of a volunteer stand every year. Our policy is to turn under the vetch every year before the seed are mature for the reason that more nitrogen and humus are stored in the soil than the money value involved in the purchase of the seed each year. In other words it pays so well when turned under that we can afford to purchase new seed each year. Bur clover may be used in the place of vetch if desired as it will also reseed. Austrian Winter peas may be used but must be planted each year.

Vetch has been grown on very poor gray land on the station and has about trebbled the yield of soybeans on this land. However, it should be borne in mind that vetch like any other crop does better on good land, so to be successful plant it on your best acres first and give it a chance. Many farmers make a failure with vetch because they plant it on the poorest soil available, where nothing else will grow. Give vetch a chance.

Where vetch is to be grazed a little during the winter and later cut for hay, it is advisable to plant oats with it. If for grazing and

turning under, use rye with vetch. A bushel of rye and fifteen pounds of vetch is a good seeding for an acre and two bushels of oats with fifteen pounds of vetch is a splendid seeding. Thirty pounds of the Austrian Winter peas with rye or oats in the place of the vetch is a mixture well recommended.

Legumes—There are two classes of legumes, winter and summer. Much benefit has been derived from using bur clover, vetch, Austrian Winter peas and crimson clover as winter legumes. Vetch and bur clover are the only ones that can be depended upon to reseed from a crop turned under. The Austrian Winter peas germinate as soon as planted and crimson clover is an annual. These legumes as a rule are ready to turn under around the middle of April.

Results of the winter legume test were given in table 12 in this bulletin.

Among the summer legumes are soybeans, velvet beans, peas and lespedeza. Lespedeza reseeds while the others must be planted every year. These legumes fit into rotations nicely and are recognized as excellent soil builders.

Pastures—Excellent pastures are easily obtained in this section by getting a start of bermuda, carpet grass, lespedeza and white clover. Paspalum or Dallas grass grow well in the lower wet places. Early spring clovers such as hop clover also help out on early spring grazing. Meadow fescue and rye grass also do well on the better classes of land. Any part of this section is well adapted to dairying provided there is a good milk market accessible. Many of our pastures carry cattle easily eight months in the year. Many cattle are never housed during the winter and when they are housed, it is for a very short period during cold rainy spells. Carpet grass, lespedeza and bermuda are native to this section.

Our pasture work on this station is getting off to a slow start, but the plats are now becoming established and have reseeded for next year.

Orchards—In addition to the old variety orchard which produces excellent peaches, apples and grapes each year, about an acre of young Elberta peach trees has been planted for fertilizer test work and has been conducted for one year. Our fruit trees are fertilized each year with one pound of a 4-8-4 fertilizer for each year of age of the tree. Results show that the orchard fruits may be produced by proper attention being given to fertilizing, pruning, spraying and cultivation.

Boll Weevil Work—Hibernation and boll weevil emergence work has been conducted in cooperation with Mr. O. M. Chance, Jackson, Mississippi, of the State Plant Board. At present there are two cages in the woods and two cages in the open fields that contain 500 weevils each. These weevils were caught in the late fall and placed in these cages. In the spring daily records will be kept to see how many emerge from the winter quarters. Those that do not emerge will be listed as not surviving the winter, while those that emerge will give

the cotton grower warning as to how many weevils to expect during the next cotton season. Several cotton states are doing this work. Ten per cent of the weevils emerged at the Raymond station during the year 1929.

In addition to this, the station is conducting poison work with cotton and results of this test may be seen in table 11. It pays to poison judiciously.

Improvements—A seed and storage house has recently been constructed on the station property. It was constructed so as to be rat and bird proof and at the same time to be well venilated. This building is painted maroon and trimmed in white to carry out the A. and M. College color scheme. The closets to the station residence have been ceiled throughout and the house is now more easily heated. A concrete porch has been constructed to the station office. Several new bridges have been constructed and new land layed off in systematized plats with roadways between each set. These roads are kept in condition by a light road machine which the station purchased. A garage for the station foreman's residence and some concrete floor work in the barn has been completed.

Conclusion—A successful year's work has come to a close. Many visitors have come to the station and many more have written or phoned in for information.

We wish to express appreciation to Dr. B. M. Walker, President of the Mississippi A. and M. College and to Director J. R. Ricks, of the Experiment Station for the kind and business-like manner in which they have directed the work of the Raymond Branch Experiment Station.

Bulletin No. 272 December, 1929

REPORT OF HOLLY SPRINGS BRANCH EXPERIMENT STATION, 1929

By
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Mississippi Agricultural Experiment Station
A. and M. College, Mississippi
J. R. Ricks, Director.

REPORT OF HOLLY SPRINGS EXPERIMENT STATION, 1929

The work at this Station for the past year has been along lines of successful and progressive agriculture. The seasons the past year were very unfavorable for growing crops, being a very wet spring and an extremely dry fall. The additional land purchased has been temporarily fenced. Some of the most important terraces have been built, and about seventy-five acres of soy beans were grown as a restorative crop and as a study of the soils. Two hundred and sixty-nine plots were planted to cotton in vorious fertilizer tests on the farm. Plantings of beans and cotton were made principally with the two row planter and cultivated with the Farmall tractor.

There is on the new farm more than one hundred acres of practically level land. After this land is tiled, we will have land well adapted to Station work.

Fertilizer tests and variety studies of cotton, corn, and other crops were grown on the Station proper.

Co-operative fertilizer tests were conducted at Nesbitt, De Soto County, Sardis in Panola County, Torrance in Grenada County, and at Lexington in Holmes County.

Insect Damage—The boll weevil, cotton hopper, red spider and plant lice all gave trouble this past season. The cotton hopper did the greatest damage on highly fertilized land.

Drainage—The controlling of surface and soil water is first in importance and has much to do with future successful agriculture.

Soil Improvement—With the farm fenced and water controlled, soil improvement is easy. The growing of clovers, vetches, and Austrian winter peas as winter cover crops, and with soy beans, cow peas and lespedeza as summer legumes, these crops can be grown as catch crops and used for forage for livestock to great advantage.

Lime Study Tests—Ninety-seven plots have been planted to various grain and winter legumes, with and without lime; also with and without fertilizers.

Two and one half acres of wilt resistant red clover is now very promising on the new farm. Lime and red clover

will receive much attention in the near future as a forage and soil improvement crop.

COTTON

The variety grown has much to do with the success of the crop. Lone Star varieties and selections from the Lone Star such as Stoneville No. 1-2-3 do well in the brown loam area. Also selection from the D. & P. L. Co. and selections from Cleveland and Miller.

The following are considered as wilt resistant varieties: D. & P. L. 6, Coker's Super Seven, Lightening Express, Cleveland 54 and Miller. A well balanced fertilizer aids greatly in checking wilt.

Preparation of Land—A well prepared firm seed bed gives good results. Frequent shallow cultivation to keep down the weeds and grass is necessary to a profitable crop.

Plant from 1½ to 2 bushels of seed per acre to aid in securing a good stand which is two to three stalks per foot. To use less seed is false economy.

Use from 600 to 900 pounds of fertilizer per acre as given under fertilizer recomendations. Apply the fertilizer about three inches below the seed. Fertilizer should be applied three or four weeks ahead of seed planting time. It frequently happens that it is necessary to apply just ahead of the planter.

Pink Boll Rot Control—Plant some other crop on the infected land the following year. Plant diseased free seed on clean land. The planting of two year old seed is recommended. Crop rotation is good for the land as well as for the cotton. Do not use varieties that are susceptible to the disease.

Boll Weevil Control—If any weevils can be found just as first squares are about half grown, calcium arsenate should be applied in the bud of the cotton either in the dust form or as a sweet poison according to desires of the operator. A second application should be made about ten days later.

Results from this Station indicate that in this latitude this second application is usually due with early planting cotton about the time most of the weevils are out of hibernation, which means most of the weevils are destroyed. After the squares are formed the weevil turn their entire atten-

tion in that direction and sweet poison would bo no longer useful.

If the cotton hopper is present Mr. B. R. Coad of the U. S. Department of Insect Control, recommends using a mixture of two pounds of powdered sulphate to one pound of Calcium Arsenate which should be used only in the dust form. When only the cotton hopper is present use 12 to 15 pounds of sulphur alone per acre. Should the weevil become plentiful later on in the season, poisoning should begin with calcium arsenate dust as soon as 10 percent of squares infestation is found. Mr. B. R. Coad recommends three applications four days apart, beginning with about 10 percent infestation. After the three applications, the weevils should be held down to about 20 percent infestation by later dustings. Poisoning by dusting with calcium arsenate is no longer an experiment, it can be very profitable if applications are made at the proper time and in the proper way.

Variety Test—Variety tests were made on both hill and valley land. The soils used on the hill land was brown loam table land of ordinary fertility. The valley land test was on improved brown loam.

Each of the thirty-three varieties was planted in one row plots and duplicated four times.

Plantings were made the latter part of April. When necessary replanting was done with a hoe.

Fertilizers—Six hundred pounds of 4-8-4 was used per acre on the hill land and eight hundred pounds of 4-8-6 on the valley land test.

HILL LAND VARIETY TEST WITH COTTON

Variety	Lbs. of Lint Per Acre	Lint Data: Per-cent	Staple	Cents per lb.	Value per acre	Percent First picking
Stoneville No. 3	602.1	39.2	1 1-16	19.30	$130.22	44.3
Rowden No. 40	557.0	35.3	1 3-32	19.35	123.09	44.3
Rowden 4053	546.7	35.4	1 1-16	19.30	120.48	38.3
Miller 589	542.5	37.4	1 1-32	19.15	117.51	43.9
Rowden 2119	517.9	35.7	1 1-32	19.15	113.17	43.5
D. & P. L. 4-8	524.0	38.1	1 1-32	19.15	113.10	46.9
Rowden 3053	519.7	36.5	1 1-32	19.15	113.08	47.3
Marthia Haaga	516.7	39.7	1 3-32	19.35	111.75	29.5
Rowden 2088	506.5	35.7	1 1-16	19.30	111.43	40.3
Miller 3286	501.3	35.8	1 1-32	19.15	109.49	41.5
Stoneville No. 2	499.6	37.1	1 1-16	19.30	109.13	49.8
Express 17	476.7	34.0	1 5-32	19.95	108.98	32.5
Lone Star 284	486.2	36.1	1 3-32	19.35	106.99	50.1
Missdel No. 2	465.9	34.9	1 5-32	19.95	105.99	50.9
D. & P. L. No. 6	471.2	35.7	1 1-8	19.70	105.56	43.3
Cleveland 54	491.9	36.3	1	18.70	104.94	41.2
Lone Star 65	475.2	35.2	1 1-16	19.30	104.83	53.3
Express Light.	458.3	34.2	1 5-32	19.95	104.66	48.1
Lone Star 561	483.1	37.8	1 1-32	19.15	104.43	51.2
Stoneville No. 1	469.2	35.1	1 1-16	19.30	103.57	52.4
Cook 1010	527.8	41.3	7-8	17.35	102.82	49.7
Half & Half Mahon	547.4	43.0	27-32	16.50	101.20	47.5
Cleveland Wilson	487.2	35.3	15-16	17.85	100.37	45.1
Delfos 63-1463	443.1	34.9	1 5-32	19.95	100.80	52.1
Acala 37	450.3	35.1	1 1-16	19.30	99.40	45.8
Express 121	446.2	34.2	1 3-32	19.35	99.22	32.9
Delfos 910	430.6	33.3	1 5-32	19.95	98.84	42.0
Delfos 0602	424.0	33.0	1 5-32	19.95	97.50	40.7
Missdel 1	424.4	34.8	1 5-32	19.95	96.60	36.9
Deltatype Web. 8	401.5	32.7	1 3-16	20.55	94.90	39.8
Cleve. Piedmont	463.5	34.5	29-32	17.60	94.78	45.6
Delfos 911	393.6	33.0	1 5-32	19.95	90.51	44.2
Cleveland Coker	397.3	36.3	1 1-32	19.15	86.40	18.0

NOTE: The above varieties are arranged in order of value per acre.

VALLEY VARIETY TEST, 1929

Variety	Lbs. of Lint Per Acre	Lint Data: Per-cent	Staple	Cents per lb.	Value per acre	Percent First picking
Stoneville No. 3	815.4	35.9	1 1-16	19.30	$179.21	20.1
Miller 589	788.3	35.4	1 1-16	19.30	173.72	12.4
Rowden No. 40	747.6	33.8	1	18.70	161.76	9.8
Cleveland 54	718.9	34.1	1 1-16	19.30	159.59	11.8
Rowden 4053	710.9	34.8	1 1-32	19.15	156.12	13.5
Stoneville No. 2	669.4	33.8	1 1-8	19.70	151.54	23.6
Rowden 3053	690.2	34.9	1 1-32	19.15	151.48	15.9
Delfos 910	597.1	30.7	1 7-32	21.75	150.09	14.2
Rowden 2088	679.3	35.3	1 1-32	19.15	148.77	13.3
Rowden 2119	672.4	33.7	1 1-32	19.15	148.61	11.3
Stoneville No. 1	652.6	33.5	1 3-32	19.35	145.71	28.3
Miller 3286	647.7	33.3	1 3-32	19.35	144.79	10.7
Misdel No. 2	610.0	32.4	1 3-16	20.55	144.45	22.4
Express 17	644.8	33.2	1 3-32	19.35	144.23	8.7
D. & P. L. 4-8	647.5	35.8	1 3-32	19.35	142.71	10.0
Lone Star 65	635.0	32.5	1 3-32	19.35	142.65	28.7
Express 121	638.0	34.1	11-16	19.30	141.62	11.6
D. & P. L. No. 6	614.5	33.7	1 5-32	19.95	140.79	20.3
Delfos 63-1463	592.8	32.3	1 3-16	20.55	140.46	21.0
Lone Star 561	638.0	35.8	1 1-16	19.30	140.29	21.3
Half & Half Mahon's	703.8	39.3	7-8	17.35	138.42	13.7
Cleveland Wilson	643.8	33.1	31-32	18.30	137.34	12.5
Delfos 911	576.3	31.4	1 3-16	20.55	137.32	20.0
Cook 1010	686.3	39.1	7-8	17.35	135.11	13.5
Missdel No. 1	560.4	33.1	1 3-16	20.55	132.15	17.1
Express Lightning	548.9	31.7	1 3-16	20.55	130.54	25.2
Lone Star 284	578.7	34.3	1 3-32	19.35	128.61	22.7
Cleveland Piedmont	625.2	33.1	7-8	17.35	127.42	10.8
Acala 37	557.9	32.5	1 1-8	19.70	127.29	14.2
Delfos 0602	533.1	31.0	1 5-32	19.95	124.15	12.4
Marthia Haaga	538.8	37.7	1 1-32	19.15	116.53	10.4
Deltatype Webber 8	451.6	30.4	1 7-32	21.75	113.73	10.0
Cleveland Coker	386.6	34.4	1 1-16	19.30	85.67	4.0

Poor stands were secured on Marthia Haaga, Coker Cleveland, Deltatype Webber and several other varieties.

We have always had trouble in getting proper germination cold wet springs where delinted seed are used.

COTTON SPACING TEST

Tests in cotton spacing were conducted this year on both hill and valley land. There is very little difference this year in the spacing of unthinned cotton. Three stalks per foot, two stalks per foot, or one stalk per foot on either

hill or valley land. The seasons were a cold wet spring followed by a very dry summer and late fall. The cotton hopper did considerable damage early in the season. The dry summer and fall held the boll weevil in check, minimizing the damage.

Our spacing recommendations are, three to four stalks per foot on hill land with rows three feet apart, and for the valley land two to three stalks per foot and rows not over three and one-half feet apart.

When two bushels of cotton seed are planted per acre, the above spacing recommendation can usually be secured, which should insure an increased yield of from 25 to 35 percent over methods frequently used.

COTTON VARIETY TEST—SEVEN YEAR AVERAGE

There is a great need of a change in the basis of production from the planting of mixed "Gin-run" seed to the planting of uniform select varieties.

Under the usual local marketing conditions there is very little apparent inducement to the grower to use improved varieties because the price paid is very little above that paid for cotton from "Gin-run" seed. As long as this condition exists the easiest way out is to sell the lint from improved varieties through a Standard Cotton market.

SEVEN YEAR AVERAGE COTTON VARIETY TEST, 1929

	Hill		Valley	
	Lint	Value	Lint	Value
Delfos 6102	419.8	107.09	554.8	153.95
Acala	453.2	105.08	549.9	151.51
Delfos 911	434.7	104.79	572.2	145.41
Express, Light'g	396.6	103.06	489.0	133.74
Lone Star 65	438.7	101.89	593.3	151.59
Delfos 910	441.8	99.78	564.8	138.62
D. & P. L. 6	469.2	98.18	584.4	133.47
Miller	409.0	95.96	573.7	141.19
Half & Half	473.9	95.63	606.5	132.20
Cleveland 54	415.0	92.49	570.4	134.80
Cleveland Piedmont	404.9	88.47	523.9	120.09

Seven year average, Cleveland 54, Lone Star 65, Lt. Express, Half and Half, Acala, Miller, Cleveland Piedmont.

Six year average, Delfos 911, and 6102.

Four year average, D. & P. L. No. 6 and Delfos 910.

COOPERATIVE FERTILIZER TEST

This work was conducted by the Holly Springs Branch Station in co-operation with County Agents and good farmers. Similar plantings were made on the Station on both hill and valley land.

Four tests were conducted this year as follows: One on the farm of Mr. Wilson at Nesbitt, in De Soto County, one on the farm of Mr. Woods near Sardis in Panola County, one near Torrance in Grenada County on the farm of Mr. Keeton, and one on the farm of Mr. Stanley near Lexington in Holmes County. The County Agents in each of these counties assisted in these tests. In the plots near Lexington only the first picking was weighed. The last picking which was very light was not weighed on account of a misunderstanding. We do not believe these weights would have made any material difference in the results.

In all co-operative work of this Station the soil is selected and the fertilizer applied and the crop gathered under the Station supervision. The crop cultivation is under farm management.

In all fertilizer work represented in this bulletin, the increase was obtained according to the standard adopted by the American Society of Agronomy as reported in Vol. 16 No. 1 of the Journel. The column marked "check yield" was obtained according to the above method by assuming that there is a gradual increase or decrease from one check to another. All plots are 1-20 acre each in size, composed of four rows and three series. Only the middle rows were used in computing yields.

FERTILIZER TEST, HILL LAND—HOLLY SPRINGS

Analysis	Average 1929			Average 1925-'29		
N-P-K	Yield	Increase	Net Gain	Yield	Increase	Net Gain
No Fertilizer	482.0			503.3		
4-8-8	1038.0	516.0	22.00	1141.9	605.7	28.37
4-8-6	1034.0	472.0	19.94	1205.9	636.7	30.90
4-8-4	1028.0	426.0	17.75	1197.5	595.4	28.93
No Fertilizer	642.0			635.0		
4-8-2	1102.0	424.0	18.21	1121.8	453.8	20.76
4-8-0	1068.0	354.0	14.58	1069.6	368.7	16.08
8-8-4	1152.0	402.0	12.31	1294.4	560.5	22.48
No Fertilizer	786.0			766.8		
6-8-4	1214.0	455.0	17.49	1176.6	433.7	16.77
4-6-4	1116.0	384.0	15.89	1125.3	406.3	17.83
4-4-4	1048.0	343.0	14.10	1049.4	354.4	15.24
No Fertilizer	678.0			671.1		
4-8-4 (1200)	1248.0	583.5	19.39	1315.9	665.4	25.30
4-8-4 (1800)	1264.0	613.0	13.34	1400.4	770.5	23.84
4-8-4 (2400)	1274.0	636.5	6.94	1438.4	829.0	19.59
No Fertilizer	624.0			588.8		

FERTILIZER TEST, VALLEY LAND—HOLLY SPRINGS

Analysis	Average 1929			Average 1925-'29		
N-P-K	Yield	Increase	Net Gain	Yield	Increase	Net Gain
No Fertilizer	758.5			1024.2		
4-8-8	1814.2	1070.0	55.24	1743.6	719.3	35.42
4-8-6	1666.3	936.4	47.80	1642.7	618.4	29.76
4-8-4	1536.9	821.4	41.47	1581.2	556.8	26.54
No Fertilizer	701.2			1024.5		
4-8-2	1259.7	552.7	25.93	1371.7	348.5	14.23
4-8-0	885.1	138.6	1.66	1179.2	157.3	2.97
8-8-4	1507.6	789.4	35.55	1496.9	476.4	17.27
No Fertilizer	723.8			1019.2		
6-8-4	1474.3	708.8	32.72	1566.6	536.2	23.12
4-6-4	1493.0	685.9	34.00	1511.0	469.5	21.75
4-4-4	1325.0	476.2	22.09	1424.1	371.4	16.30
No Fertilizer	890.4			1063.8		
4-8-4 (1200)	1643.6	790.8	31.83	1750.6	699.2	27.40
4-8-4 (1800)	1827.5	1012.4	37.30	1768.2	729.2	21.28
4-8-4 (2400)	1974.2	1196.7	40.55	1810.3	783.7	16.78
No Fertilizer	739.8			1014.2		

COOPERATIVE FERTILIZER TESTS

Analysis N-P-K	Grenada Increase	Grenada Net Gain	Sardis Increase	Sardis Net Gain	Nesbitt Increase	Nesbitt Net Gain	Lexington Increase	Lexington Net Gain
4-8-8	665.2	34.09	520.3	22.48	413.3	15.84	514.3	21.90
4-8-6	759.8	40.83	320.2	11.03	332.9	11.59	478.6	20.33
4-8-4	619.1	32.27	354.8	13.65	318.0	11.27	412.9	16.96
4-8-2	558.2	28.90	349.8	13.91	251.2	7.84	241.2	7.24
4-8-0	497.2	25.52	289.5	10.83	193.7	4.96	81.4	-1.78
8-8-4	659.1	30.53	508.7	18.80	336.2	8.36	489.7	17.57
6-8-4	669.0	33.35	450.7	17.36	311.3	8.87	548.5	23.10
4-6-4	567.5	29.53	342.1	13.50	326.8	12.46	497.1	22.68
4-4-4	534.7	28.02	351.0	14.65	290.2	10.93	509.7	24.10
4-8-4 (1200)	596.5	22.83	619.1	21.88				
4-8-4 (1800)	653.9	18.58						
4-8-4 (2400)	778.8	18.73						
4-10-4					332.3	11.46	624.3	28.98
4-0-0					150.4	5.02	272.8	12.37
4-0-4					307.2	13.28	615.4	31.77

NOTE: The above fertilizers were mixed and applied on a six hundred pound basis except those designated as 1200, 1800, and 2400 pound applications.

INCREASE represents the amount of seed cotton produced by the FERTILIZED PLOTS over the NO FERTILIZER PLOTS.

GRENADA and SARDIS tests are averages for two years.

NESBITT and LEXINGTON tests are averages for one year.

Graph 1.

Pounds material applied per acre

Hill Land

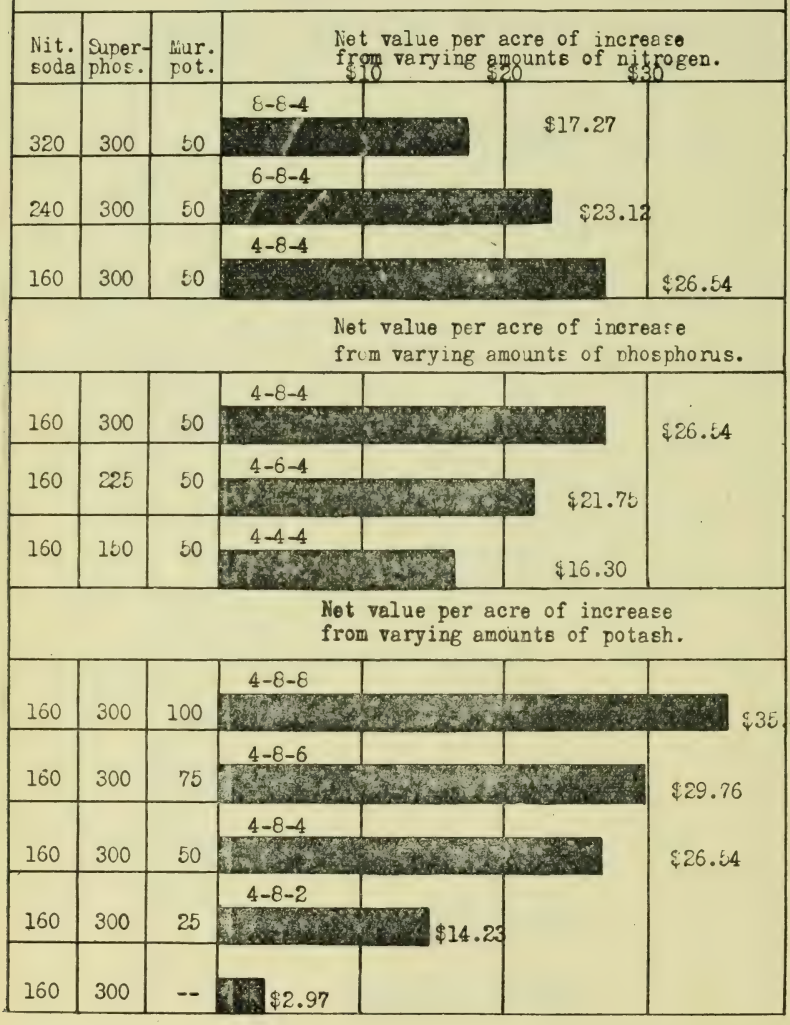
Average 1925 - 29.

Nit. Soda	Super-phos	Mur. Pot.	Net value per acre of increase from varying amounts of nitrogen. $10 $20 $30
300	300	50	8-8-4 $22.48
240	300	50	6-8-4 $16.47
160	300	50	4-8-4 $28.93
			Net value per acre of increase from varying amounts of phosphorus.
160	300	50	4-8-4 $28.93
160	225	50	4-6-4 $17.83
160	150	50	4-4-4 $15.24
			Net value per acre of increase from varying amounts of potash.
160	300	100	4-8-8 $28.37
160	300	75	4-8-6 $30.90
160	300	50	4-8-4 $28.93
160	300	25	4-8-2 $20.76
160	300	--	4-8-0 $16.08

Graph 2.

Valley Land.

Average 1925 - 29.



FERTILIZER RECOMMENDATIONS

The following recommendations are derived from the five year averages of Hill and Valley tests at Hally Springs and from co-operative tests conducted in other parts of this section.

The cotton farmers in this section should use 600 to 900 pounds of fertilizer per acre as follows: On improved soils, where legumes have been grown or manures used, one should use a mixture of 160 pounds of nitrate of soda or its equivalent in other forms of soluable nitrogen, 300 pounds of superphosphate (acid phosphate) and 75 pounds of muriate of potash or other forms of potash. This mixture is equivalent to 600 pounds of 4-8-6 factory mixed fertilizer.

On the thinner soils where the stalk growth is comparatively small, it will be found profitable to add 80 pounds nitrate of soda, or other forms of soluable nitrogen to the above mixture. This will make an equivalent to 600 pounds of 6-8-6 factory mixed fertilizer. The same quantities of 4-8-6 or 6-8-6 factory mixed can be used provided most of the nitrogen is from a readily soluable source.

Where rust and leaf diseases are prevalent, additional potash should be added.

The tendency with fertilizer factories now is to manufacture high grade goods. These high grade fertilizers can be sold cheaper per unit than the lower grades on account of saving in freight, sacks, handling, etc. Our recommendations are one part of nitrogen, two parts of phosphorus, and one and one-half part of potash. The tendency in some instances is to use more phosphorus than is necessary to balance the nitrogen and potash.

Nitrogen Source Test—This test was conducted on uniform thin brown loam unimproved table land that has been cropped for more than one-half century to cotton with practically no soil improvement methods having been used. All plots 1-20 acre each in size and repeated three times. Each nitrogen carrier given in the table below was applied at the rate of 36 pounds of available nitrogen per acre. All plots including checks, received in addition to the nitrogen 450 pounds of super phosphate and 72 pounds of muriate of potash per acre in order that deficiencies in these materials would not render the nitrogen comparison useless. The increase was obtained by assuming that there was a gradual

increase or decrease in fertility from one check to another as is adopted by the American Society of Agronomy.

MAIN NITROGEN SOURCE TEST, 1929

600 lbs. 6-12-6 per acre	Yield	Increase	Percent Increase
Nit. Soda	838.0	462.5	123.2
No Fertilizer	410.0		
No Nitrogen	388.0	-56.5	-12.7
Cal. Nitrate	896.0	417.0	87.1
Nit. Soda	976.0	462.5	90.1
Ammon. Sulphate	898.0	414.5	85.7
Calurea	826.0	372.5	82.1
Cal. Cynamid	764.0	340.5	80.4
Nit. Soda	856.0	462.5	117.5
Leunasalpeter	838.0	432.5	104.4
Calnitro	854.0	436.5	104.6
Ammon. Sulphate / Nit. Soda	812.0	382.5	89.1
Nit. Soda	904.0	462.5	104.8

Secondary Nitrogen Source Tests—Similar soil was used to that of the main nitrogen test. Plots 1-20 acre each repeated four times. The materials used for each plot were made to conform to 600 pounds of 6-8-6 fertilizer. It should be remembered that the results given above are for one year only.

SECONDARY NITROGEN SOURCE TEST, 1929

600 lbs. 6-12-6 per acre	Yield	Increase	Percent Increase
Nit. Soda	854.7	503.6	143.4
No Fertilizer	349.8		
No Nitrogen	393.8	45.3	13.0
Plant Food	823.9	476.8	137.4
Ammo-Phos-Ko	704.0	358.2	103.6
Nit. Soda	848.1	503.6	146.2
Ammo-Phos.	690.8	349.3	102.3
Nitrophoska	716.1	377.6	111.6
Urea	663.3	327.9	97.8
Nit. Soda	836.0	503.6	151.5

Potash Source Test—The soil used in this tests is thin level brown loam that has been grown to cotton for fifty years with little if any soil improvement methods used. The cold wet spring hindered growth very materially. All

plots were in triplicate. Each potash carrier given in the table was applied at such a rate as to supply 36 pounds of available potash per acre. All plots including no potash plots, received in addition to the Potash 240 pounds of nitrate of soda and 450 pounds of super phosphate. The increase was obtained by assuming that there was a gradual increase or decrease in fertility from one check to another.

POTASH SOURCE TEST, 1929

600 lbs. 6-12-6 per acre	Yield	Increase	Percent Increase
Muriate	931.8	465.6	99.9
No Fertilizer	459.9		
No Potash	826.5	373.0	82.2
Kainit	922.4	475.2	106.3
Muriate	906.4	465.6	105.6
Trona	863.8	432.0	100.0
Sulphate	831.8	409.0	96.7
Manure Salts	874.4	460.6	111.3
Muriate	870.4	465.6	115.0

POTASH INCREASE TEST, 1929

600 lbs. per acre N-P-K	Yield	Increase	Percent Increase
8-12-6	956.0	714.0	29.5
No Fertilizer	224.0		
8-12-0	822.0	616.0	29.9
8-12-2	858.0	670.0	35.6
8-12-4	898.0	728.0	42.8
8-12-6	866.0	714.0	47.0
8-12-8	874.0	722.0	47.5
8-12-10	802.0	650.0	42.8
8-12-12	842.0	690.0	45.4
8-12-6	866.0	714.0	47.0

Phosphate Source Test—Soil slightly rolling unimproved very thin brown loam. All plots were 1-20 acre in size and triplicated. It will be noted that the superphosphate plot is used as a check. The check column in Table No. 12 below was obtained by assuming that there was a gradual increase or decrease in fertility from one check to another, as is adopted by the American Society of Agronomy. The increase column in this table in each instance shows a less quantity than the check plot which is indicated by a minus sign. The percent of increase column in this instance is also less in each instance than the check plot .

This is the first year's results on this land. The seasons were unfavorable.

PHOSPHORUS SOURCE TEST, 1929

Kind of fertilizer	Yield	Check	Increase	Percent Increase
240 lbs. Nitarte soda 300 lbs. Super Phos. 72 lbs. Muriate Potash	991.8	991.8		
No Potash	935.8	1009.1	-73.3	-7.3
240 lbs. nitrate soda 300 lbs. Rhume's Phos. 72 lbs. Muriate Potash	945.1	1026.5	-81.4	-7.9
240 lbs. Nitrate Soda 300 lbs. Colloidal Phos. 72 lbs. Muriate Potash	947.8	1043.8	-96.0	-9.2
240 lbs. Nitrate soda 300 lbs. Super Phos. 72 lbs. Muriate Potash	1061.1	1061.1		

CORN

Most of the corn grown on the Station is after some winter cover crop such as vetch, or vetch and Austrian winter peas, sown together with some kind of small grain, such as oats, wheat or rye. By this method two full crops are grown on the land every twelve months. Land will improve in productiveness under such a method when the fertilizer requirements are maintained and soy beans are grown in the corn and turned under as a restorative crop.

There is no crop that responds quicker to thorough preparation of the soil than does corn. Every row of corn planted in the state should be planted to soy beans. It is the easiest and cheapest method to maintain soil fertility.

On good land it is easy to turn under 12 to 15 dollars worth of nitrogen per acre in a soy bean crop in addition to the organic matter they contain. The O-too-tan and Biloxi are varieties well adopted for this purpose. Our method is to use a double hopper planter that drops a hill of corn and a hill of beans about fifteen inches apart. We remove one hill of corn later. This method will leave the hills of corn about 30 inches apart and leave two hills of beans between each hill of corn. The distance the hills of corn should be a part can be determined by the fertility of

the soil,—the poorer the soil, the greater the distance. Corn is a rich land plant. In many instances soy beans should surplant the growing of corn altogether when the soil is thin.

Planting—Early in the season shallow planting is advisable. As the soils warm up deeper planting should be made. Early plantings around May 1st, usually give best results, as the seasons are more favorable for development than they are for later plantings.

Cultivation—Medium shallow cultivation gives good results. The section harrow does good work when drawn diagonally across the rows for the first working. About five cultivations are necessary for good results.

CORN VARIETY TEST

Plots—One row each, planted in checks and repeated six times. Date of planting, the middle of May. Fertilizer used, 150 pounds of Nitrate of soda mixed with 200 pounds super phosphate and 40 pounds of muriate of potash.

CORN VARIETY TEST, 1929

	Per cent Grain	Bushels shelled corn per acre	Rank	Average 1923 Thro 1929
Mosby, Station	73.8	60.8	10	61.1
Mosby, Delta	78.0	63.4	8	61.9
Mosby, D. & P. L.	75.9	71.2	5	
Mosby, Suttle	79.5	77.8	2	65.9
Mosby, Cork	80.4	59.1	12	
Coke's Pro. Sta.	76.0	70.0	6	
Coke's Pro. Delta	76.9	59.9	11	61.4
Hastings	78.9	82.4	1	67.6
College 47	74.7	61.2	9	
Laguna	72.7	53.2	14	54.8
Mexican June	75.3	52.0	15	51.7
Paymaster, Neal	75.6	71.7	4	67.0
Paymaster, Fisher	75.3	76.1	3	
Yellow Dent	72.4	38.6	16	
College Y-4	72.9	64.4	7	
Golden Dent	69.8	37.8	17	
College G-4	73.0	56.0	13	

Hasting's Prolific, Mosby, Cocke's Prolific, Neal's Paymaster, and College Yellow Y.4 are all good varieties to plant. In the six years average table given above, Mosby

Delta gave 61.9 bushels; Station Mosby, 61.1 bushels; Mosby Suttles, 65.9 bushels; Hasting's Prolific, 67.6 bushels; Paymaster Neal's, 67.0 bushels; College Yellow gave a yield this year of 64.4 bushels.

FERTILIZER TEST WITH CORN

The soil employed in this test was valley land after a grain crop was harvested.

Plots 1-20 acre each consisting of four rows, planted in duplicate.

CORN FERTILIZER TEST

600 lbs. Fertilizer per acre	Yield	Increase	Net Gain
4-8-4	45.2	18.4	15.19
8-8-4	51.2	23.6	17.69
6-8-4	46.4	17.9	12.57
2-8-4	42.4	13.1	10.57
0-8-4	42.1	12.0	11.19
8-0-0	42.4	11.4	6.25
4-8-4	50.2	18.4	15.19
No Fertilizer	30.9		
8-0-4	40.2	10.3	3.73
8-8-0	37.2	8.2	-.41
4-4-4	44.5	16.4	14.02
4-8-8	44.6	17.5	12.92
4-8-4	44.6	18.4	15.19

From the above results it appears that 600 pounds of 4-8-4 is very near the fertilizer requirement for this particular soil.

CORN AND BEAN TEST

The corn and bean planting was made after three tons of oats and vetch were removed from the land, which was the middle of June.

Plots—6 rows each repeated three times.

Fertilizer used—400 pounds 4-8-4 mixture.

CORN AND BEAN TEST

	Average Yield
6 Rows corn	55.3 Bu.
6 Rows corn and soy beans	48.8 Bu.
4 Rows corn, 2 Rows beans	40.8 Bu.

The seasons the past fall were very dry. Some damage to the corn can be seen in the above table where corn

and beans were planted together. This is usually the case a dry season. The corn and bean land will be much more productive the next year. We advise planting beans in every row of corn planted.

SILAGE

Sorghum produces at least one-third more tonnage per acre, and frequently double the tonnage on any kind of land, than corn and has very near the same feeding value ton for ton. Japanese and Texas seeded cane are both excellent varieties. Plant in rows and thin to two or three stalks per foot. Where a heavy tonage is expected, 1,000 pounds of 6-8-6 fertilizer will give good results. Sorghum silage is as cheap a suculent food for cattle as can be grown. Twenty-five tons of silage per acre can be grown on good land a favorable season. A trench silo on clay soils properly handled, keeps silage as good as a concrete silo. They cost only the digging.

SWEET POTATOES

The sweet potato crop was almost a failure in this section this year. The extreme wet spring caused much loss by the potatoes rotting after they were put out in the seed bed. Only a small acreage was planted this year. A fertilizer test was conducted in which 600 pounds of 6-8-4 fertilizer gave the best results.

These results were of such a nature we deemed it advisable not to publish same. As a usual thing, sweet potatoes do extra well in this section. It is not uncommon to make 300 to 400 bushels per acre on average land with a little fertilizer.

With proper care in using diseased free seed in clean seed beds, and transplanting to land where potatoes have not been grown for several years this crop could be a rival in money value with cotton. The sweet potato furnishes a most excellent table food.

The State Plant Board is doing much to rid the state of black rot and other potato diseases. Get in touch with these men in your county. They will be glad to help any one.

Nancy Hall is one of the best standard varieties. The Tiumph is used when the potatoes are marketed in late summer.

Harvesting and Storage—Much care should be used in digging not to bruise the potatoes in the least. All cut and damaged potatoes should be removed and handled separately. Digging should be done not later than frost. If the vines are killed by frost they should be removed at once with rake and hoe and the potatoes dug as early as possible. When potatoes are diseased free, the old fashion bank method is O. K., if diseased free soil is used in making the bank. When curing houses are used, get rid of the excessive water soon after digging as practical. After the potatoes are dried out 45° temperature is considered ideal.

VETCH

Circular No. 74, issued by this Station in 1927 is available.

Every land owner should be interested in maintaining soil fertility. After the surface water has been controlled on a farm by terraces the next step is to grow legumes, both summer and winter. Sow from 15 to 30 pounds of hairy vetch seed, properly inoculated, in the middles of any well cultivated crop, usually cotton, at any time from September 15th to November 1st. It is advisable to use a small middle breaker run shallow, cover the seed from two to two and one-half inches deep to insure proper moisture for quick germination. The latter part of September is the best date for planting the seed in this section. More profitable crops are grown following legumes without any additional cost. Vetch can be grown with any small grain such as rye, wheat, or oats.

AUSTRIAN FIELD PEA

This crop is fast growing into popularity in the state. The plant is about as hardy as vetch and is handled as you would vetch except it requires a third more seed to make a good seeding. The growth is more rapid in the spring than vetch and for that reason is preferred by some to vetch. It requires at least 30 pounds of seed to plant an acre.

This plant is used to a considerable extent to be turned under as a green manure where the land is to be followed with cotton. When grown with small grain it makes a splendid hay if the grain is cut in the dough stage.

SOY BEANS

The soy bean should occupy first place as a forage crop

for the hill section of the state. O-too-tan, Biloxi, Yellow Mammoth, and Laredo are all good varieties.

For the hill section better results are obtained when plantings are made in narrow rows and given about two cultivations. On thin land 500 pounds of a 2-8-6 fertilizer will pay. Soy beans should be planted in every row of corn and either grazed off or turned under to maintain soil fertility.

Variety plantings were made this year on this land. This plant and Lespedeza should be the main hay crop for the farmers of this section, especially the dairy farmer.

Proper inoculation is advisable when soy beans are to be planted on land that has not grown soy beans.

ALFALFA

We have never failed to get good results in growing alfalfa where fall plantings are made. A fertile, sweet, well drained soil of any type in this section will grow good alflafa. It usually requires about four tons of crushed limestone per acre to sweeten the soil. Five hundred pounds of super phosphate and 100 pounds of muriate of potash meets the mineral requirements for a year or two. Late September is a good date to plant the seed. A well prepared firm seed bed is necessary.

Seed known on the market as Common Alfalfa have given as good results as any variety we have grown. Our planting at present is on a red clay hill. The dry summer and fall allowed only four cuttings the past year. A few acres of alfafla is fine on a farm for chickens, hogs and calves, and usually saves a hay bill in early summer. It is advisable to use 25 pounds of seed per acre. Proper inoculation is very necessary. Soil from a field growing seed at the rate of one-half pound of soil to each pound of seed, gives good results.

We strongly advocate planting at least a smell acreage near the home on every farm.

DAIRYING

The station now owns a herd of registered Jersey cows. These cattle furnish a market on the farm for surplus legumes and other farm crops.

These cattle are kept under a shed properly bedded during the entire winter and only removed twice daily for milking. They are fed hay under the shed and silage and grain in the milk barn. The manure from the shed is removed in the spring direct to the farm.

The dairy interferes very little with farm work. One man with a milking machine attends to the entire work of milking twenty cows twice daily and all other work connected with the dairy.

There are five requisites to successful dairying in the section. First, the man to be dairy minded; second, good pastures; third, an abundance of home grown feed of the proper kind; fourth, the cow of a productive type; and fifth, the market. Markets of all kinds are close at hand practically all over the section.

The kind of pasture determines to a great extent the success of the business. Insufficient pasture and having to buy most of the feed is responsible for most failures in dairying.

Pastures—Land should be prepared and seeded as you would for other crops. The grasses and clovers that give good results in this section are as follows: Bermuda grass, Carpet grass, Dallas grass, Lespedeza, White and Hop Clover. On fertile soils orchard grass can be added. A mixture of these plants gives good results. On thin land Lespedeza and Bermuda grass and Hop Clover give the best results.

On fertile soils Dallas and Orchard grass mixed with White Clover, Lespedeza and Hop Clover will make a wonderful pasture.

Forage Crops—The forage crops for this section are Soy beans, Lespedeza, sorghum silage and alfalfa could be grown on many farms.

Thirty-five pounds of silage, ten pounds of Legumenous hay and one pound of the following grain mixture to each three pounds of milk—two pounds of corn and cob meal, one pound of cotton seed meal, one pound of ground oats or one pound of wheat brand makes a good ration.

Dairying does not mean less cotton, but more fertile soil on which to grow larger crops.

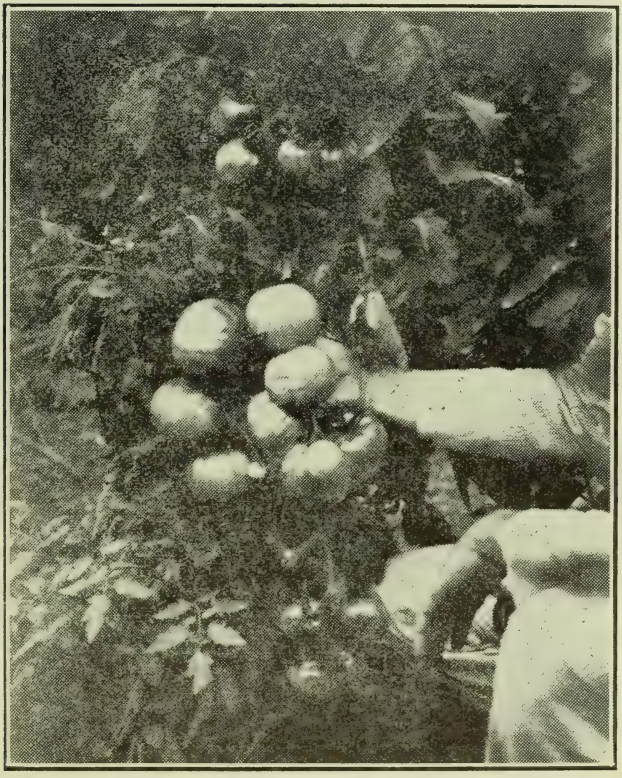
In conclusion, I wish to state that Otis B. Casanova and O. K. Morgan have assisted very materially in the success of the year's work.

Dr. B. M. Walker and Director J. R. Ricks have been very kind and pleasant in directing the work.

Bulletin No. 273 January, 1930

NITROGEN FERTILIZERS FOR TOMATO PRODUCTION

By
J. L. Cooley, Jr.



The above photo shows a plant staked and trained to a single stem.

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
J. R. Ricks, Director.

INTRODUCTION

The purpose of this bulletin is to discuss the use of commercial fertilizers in the economical production of tomatoes. A study has been made of the effect of the various nitrogen sources, and rates of application, on earliness, per cent of shipping fruit, per cent of culls, and their carrying qualities to distant markets.

This investigation consisted of tests of nine different sources of nitrogen, of three different rates of application, of nitrate of soda and ammonium sulphate side dressings, and of long-distance shipping qualities, with both spring and fall crops. The purpose was to determine the most economical source of nitrogen, rate of application, and side-dressing combination, for producing the largest yield of the best grade and size of marketable tomatoes. The long-distance shipping test was to determine the effect of heavy applications of nitrate of soda, in a complete fertilizer, on the shipping and keeping quality of the fruit.

DESCRIPTION OF THE TESTS

The tests with the spring crop were conducted over a period of three years at the Raymond branch station on the northern edge of the great trucking section of the state. The fertilizers were applied in a 4-8-3 (nitrogen, phosphorus, potash) analysis and in three replications. The phosphorus was derived from 16 per cent superphosphate, and the potash from 50 per cent muriate of potash. The nitrogen was derived from sources as given in the tables, with the exception of the combination sources; in which case the nitrogen was derived in equal quantities from nitrate of soda, sulphate of ammonia and cottonseed meal. The fertilizer was applied ten days before the plants were set. The plants were set two feet apart in three and one-half foot rows, and were staked and trained to a single stem. The plants were topped with four clusters of fruit. All plants were of the Globe variety. The fruit was harvested in the "green wrap" stage of ripeness and marketed at six cents per pound. All fertilizers and fruit were weighed to 1-100 of a pound. The fruit was graded in compliance with U. S. standard grades: U. S. No. 1, No. 2, and culls. The long-distance shipping test consisted in shipping fruit from the plots receiving 1000, 2000, 2500, and 3000 pound applications, where nitrate of soda was the only nitrogen source in four baskets carrying flat crates by local exress to the Bureau of Agricultural Economics, U. S. D. A., New York City, for a careful and rigid inspection. The government inspectors were given no details of the test in order to remove the possibility of a partial inspection.

The tests with the fall crop were conducted at the Horticultural Department of the Mississippi A. & M. College. The details of these tests were the same as for the spring crop, except that the plants were set three feet apart in four foot rows, and the fruit was harvested in the "pink" stage of ripeness. These tests were conducted for only two

years due to the fact that the plants for the 1929 tests were killed in the hotbed.

DESCRIPTION OF THE SOILS

The soil for the spring crop is located in the brown loam area, bordering on the eastern edge of the loess soils of the trucking region. The soil may be described as "made" bottom land, the top soil a silt loam with a white clay subsoil.

The soil for the fall crop is located in the lime region about three miles from the "flat-woods" soil area, in the Horticultural Department grounds of the Mississippi A. & M. College. The topsoil is Oktibbeha silt loam with a Houston clay subsoil.

Table 1—Nitrogen Source Test—Spring Crop, Raymond Station

gen es	Pounds per acre		Per cent ship- pers	Per cent picked early		Dollars per acre			Aver- age size per pound
	Total	Ship- pers		Total	Ship- pers	Total value @ 6c per pound	Cost of fertz.	Net profit	
				1927					
				(1500 pound application of a 4-8-3)					
te of Soda	16706	12059	72.1	43.0	44.4	723.54	20.63	702.91	.261
onium Sulphate	12790	8221	64.2	49.4	50.5	493.26	17.39	475.87	.258
nseed Meal	17005	11012	64.7	45.1	46.8	660.72	20.16	640.56	.284
ination	16845	12301	73.0	46.4	48.0	738.06	19.36	718.70	.296
Soda & C. S. Meal	20339	14522	71.4	52.1	53.3	871.32	20.39	850.83	.329
. Sulphate & C. S. Meal	16290	10473	64.2	48.2	52.8	628.38	18.77	609.61	.297
	15250	10720	70.2	49.1	53.3	643.20	12.90	630.30	.267
				(2000 pound application of a 4-8-3)					
te of Soda	16694	11936	70.3	45.0	47.8	716.16	27.49	688.65	.282
onium Sulphate	19325	12339	63.3	45.0	51.6	740.34	23.20	717.14	.273
nseed Meal	17750	11989	67.5	50.9	57.4	719.34	26.87	692.47	.277
ination	17112	10682	62.3	46.8	52.8	640.92	25.40	615.52	.281
Soda & C. S. Meal	17982	11847	65.8	52.5	57.5	710.82	27.17	683.65	.283
. Sulphate & C. S. Meal	18304	11403	62.2	54.1	59.9	684.18	25.03	659.15	.280
	19197	12211	63.0	52.0	57.5	732.00	17.20	714.80	.286
				1928					
				(1500 pound application of a 4-8-3)					
te of Soda	6013	3053	50.8	61.3	50.7	183.18	20.63	162.55	.206
onium Sulphate	5443	2895	53.2	66.3	42.2	173.70	17.39	156.31	.128
nseed Meal	5860	3298	56.2	56.2	30.6	197.88	20.16	177.72	.202
ination	5645	2900	51.2	70.9	50.8	174.00	19.36	154.64	.225
Soda & C. S. Meal	5264	2819	53.5	58.9	53.3	169.14	20.39	148.75	.199
. Sulphate & C. S. Meal	5351	2842	53.1	59.7	53.1	170.52	18.77	151.75	.186
	6358	3231	50.8	55.0	50.8	193.86	12.90	180.96	.205
				(2000 pound application of a 4-8-3)					
te of Soda	6336	3344	52.7	60.8	52.7	200.64	27.44	173.20	.203
onium Sulphate	4315	2513	58.2	73.3	58.2	150.78	23.20	127.58	.201
nseed Meal	5594	2814	50.3	62.5	52.7	168.84	26.87	141.97	.201
ination	5551	2716	48.9	55.2	48.9	162.96	25.40	137.56	.196
Soda & C. S. Meal	6376	3520	55.2	62.7	55.2	211.20	27.17	180.43	.191
. Sulphate & C. S. Meal	5065	2735	54.0	44.2	54.0	164.10	25.03	139.07	.184
	5332	2920	54.7	62.6	54.7	175.20	17.20	158.00	.181

Table 1 (Cont'd.)—Nitrogen Source Test—Spring Crop, Raymond Station

Nitrogen sources	Pounds per acre Total	Pounds per acre shippers	Per cent shippers	Per cent picked early Total	Per cent picked early shippers	Dollars per acre Total value @ 6c per pound	Dollars per acre Cost of fertz.	Dollars per acre Net profit	Ave age siz per pou
1929									
(1500 pound application of a 4-8-3)									
Nitrate of Soda	17279	10411	60.2	42.2	40.8	624.66	20.64	604.02	.27
Ammonium Sulphate	16024	10661	66.5	49.4	44.8	639.66	19.08	620.58	.26
C. S. Meal	16698	11126	66.6	44.1	41.0	667.56	31.44	636.12	.26
Combination	17183	11134	64.8	41.9	38.4	668.04	23.60	644.44	.27
N. of Soda & C. S. Meal	17162	11234	65.4	42.9	38.8	674.04	25.86	648.18	.26
Amm. Sulphate & C. S. Meal	17766	11356	63.9	45.4	44.0	681.36	25.26	656.10	.25
Calurea	16423	11084	67.5	39.4	35.9	665.04	18.68	648.36	.26
Calcium Nitrate	16230	11089	68.3	38.6	35.8	665.34	20.64	644.70	.25
(2000 pound application of a 4-8-3)									
Nitrate of Soda	15849	10293	64.9	41.0	36.5	617.58	27.52	591.86	.25
Ammonium Sulphate	16259	9898	60.9	43.7	39.3	593.88	25.44	568.44	.26
C. S. Meal	17346	11970	69.0	40.2	38.0	718.20	41.92	676.28	.27
Combination	16816	10797	64.2	42.1	38.6	647.82	31.47	616.35	.26
N. of Soda & C. S. Meal	15847	10328	65.2	39.4	39.2	618.68	34.48	585.20	.26
Amm. Sulphate & C. S. Meal	17062	10900	63.9	37.9	36.2	654.00	33.68	620.32	.26
Calurea	16501	10564	64.0	41.1	37.9	633.84	22.24	611.60	.27
Calcium Nitrate	17536	11947	68.1	37.1	33.6	716.82	27.52	689.30	.25
Average of 1927, 1928 and 1929									
(1500 pound application of a 4-8-3)									
Nitrate of Soda	13333	8508	64.4	48.9	45.3	510.48	19.96	490.52	.24
Ammonium Sulphate	11459	7259	62.8	55.1	45.9	435.54	18.40	417.14	.21
C. S. Meal	13188	8445	63.6	48.5	39.5	506.70	34.00	472.70	.24
*Combination	13224	8779	66.7	53.1	45.7	526.74	24.10	502.64	.26
N. of Soda & C. S. Meal	14255	9525	66.9	51.3	48.5	571.50	26.98	544.52	.26
Amm. Sulphate & C. S. Meal	13136	8224	62.3	51.1	50.0	493.44	26.20	467.24	.24
Urea	10804	6976	64.6	52.1	52.1	418.56	16.60	401.96	.23
Calurea	16423	11084	67.5	39.4	35.9	665.04	16.18	648.86	.26
Calcium Nitrate	16230	11089	68.3	38.6	35.8	665.34	19.96	645.38	.25
(2000 pound application of a 4-8-3)									
Nitrate of Soda	12690	8524	65.9	48.9	45.7	511.44	26.60	484.84	.24
Ammonium Sulphate	13300	8250	62.2	54.0	49.7	495.09	24.52	470.48	.24
N. of Soda & C. S. Meal	13402	8565	63.8	51.5	50.4	513.90	35.96	477.94	.24
Amm. Sulphate & C. S. Meal	13477	8346	61.6	45.4	50.1	500.76	34.92	465.84	.24
Urea	12265	7566	61.7	57.3	56.1	453.96	22.12	431.84	.23
C. S. Meal	13563	8925	65.3	51.0	46.1	535.50	45.32	490.18	.24
Combination	13160	8065	60.8	48.0	46.8	483.90	32.12	451.78	.24
Calurea	16501	10564	64.0	41.1	37.9	633.84	21.56	612.28	.27
Calcium Nitrate	17536	11947	68.1	37.1	33.6	716.82	26.60	690.22	.25

NOTE: The Urea source was used only in 1927 and 1928.
The Calurea and Calcium Nitrate sources were used only in 1929.

*The Combination source was composed of equal quantities of nitrogen from Nitrate of Soda, Ammonium Sulphate and Cottonseed Meal.

NITROGEN SOURCE TEST (SPRING CROP)

As shown in Table No. 1, a 1500 pound application of fertilizer deriving half of its nitrogen from nitrate of soda and half from cotton-

seed meal, gave the highest yield per acre, which was valued at $544.52 above the cost of fertilizer. The combination and nitrate of soda sources produced the next best results, in the order named. The urea and calcium nitrate sources gave very good results for the only year they were tested.

In the 2000 pound application, the cottonseed meal and nitrate of soda sources led the test, producing net profits per acre of $490.18 and $484.84, respectively. The source composed of equal quantities of nitrogen from nitrate of soda and cottonseed meal gave the third best results, with a net profit per acre of $477.94. These three sources also produced a very high per cent of shippers and very large fruit.

These results show very little difference in a slow acting and a quick acting nitrogen, or a combination of the two, as to earliness of crop.

Table No. 2—Nitrate of Soda Rate Test—Spring Crop, Raymond Station

(In a 4-8-3 analysis)

of ications:	Pounds per acre		Per cent	Per cent picked early		Dollars per acre			Average size
	Total	Shippers	Shippers	Total	Shippers	Total value @ 6c per pound	Cost of fertz.	Net profit	per pound
				1927					
0 lbs. per acre	18301	12083	66.2	46.9	53.2	724.98	13.72	711.26	.280
0 lbs. per acre	19441	13928	71.1	44.7	47.2	835.68	34.35	801.33	.336
0 lbs. per acre	15161	10523	69.4	47.2	48.1	631.38	41.24	590.14	.239
				1928					
0 lbs. per acre	4651	2747	59.0	37.2	59.0	164.82	13.72	151.10	.192
0 lbs. per acre	5829	3757	64.4	57.3	64.4	225.42	34.35	191.07	.207
0 lbs. per acre	6491	4367	67.3	71.2	67.3	262.02	41.24	220.78	.208
				1929					
0 lbs. per acre	13449	7064	52.5	32.9	37.2	423.84	13.76	410.08	.241
0 lbs. per acre	15648	10004	64.0	28.0	30.2	600.24	34.40	565.84	.264
0 lbs. per acre	14530	8765	60.3	35.7	39.9	525.90	41.28	484.62	.266
				Average for 1927, 1928 and 1929					
0 lbs. per acre	12134	7298	60.6	39.0	49.8	437.88	13.30	424.58	.238
0 lbs. per acre	13639	9230	68.0	43.3	47.3	553.80	33.25	520.55	.269
0 lbs. per acre	12061	7885	65.9	51.4	51.8	473.10	39.90	433.20	.238

NITRATE OF SODA RATE OF APPLICATION TEST

(Spring Crop)

This test was conducted to determine the most profitable rate of application of a complete fertilizer, using nitrate of soda as the nitrogen source; and whether or not the heavy applications caused fruit cracks, puffs, etc.

As given in Table No. 2, the 2500 pound per acre application led the test, producing the highest per cent of marketable fruit and the average largest fruit. This rate of application produced a net profit

per acre of $520.55. The 3000 and 1000 pound applications gave the next best results, respectively. These results indicate that a 3000 pound application will not pay the large net profit produced by the 2500 pound application; although it will produce a greater profit than the 1000 pound application.

No harmful effects such as fruit cracks, puffs, etc., were produced even by the very heavy applications. As given in the shipping test, it is evident that the fruit from these heavy applications shipped well and kept well in a marketable condition while in storage.

Table 3—Nitrogen Source and Side-Dressing Test—Spring Crop, Raymond Statio

(1000 pound application of a 4-8-3)

Nitrogen formula sources	200 lbs. per acre (except 150 lbs. Amm. Sul.) nitrogen side-dressing sourses	Pounds per acre		Per Cent Shippers	Per Cent picked early		Dollars per acre			Ave age siz per pou
		Total	Shippers		Total	Shippers	Total value @ 6c per pound	Cost of fertz,	Net profit	
				1927						
N. of Soda	N. of Soda	17527	12404	70.7	43.0	43.8	744.24	19.72	724.52	.31
N. of Soda & Meal	N. of Soda	16073	11170	69.4	46.3	49.6	670.20	19.56	650.64	.2
Amm. Sul. & Meal	Amm. Sul.	16929	11150	65.8	47.1	50.3	669.00	13.48	655.52	.2
C. S. Meal	N. of Soda	17486	12388	70.8	46.7	47.2	743.28	19.40	723.88	.2
				1928						
N. of Soda	N. of Soda	6633	3691	42.7	38.2	55.6	221.46	19.72	201.74	.17
N. of Soda & Meal	N. of Soda	5225	3144	59.0	51.4	60.1	188.64	19.56	169.08	.1
Amm. Sul. & Meal	Amm. Sul.	4455	3000	72.9	70.4	67.3	180.00	13.48	166.52	.1
C. S. Meal	N. of Soda	5931	4109	55.0	52.7	69.2	246.54	19.40	227.14	.1
				1929						
N. of Soda	N. of Soda	12924	7410	57.3	38.1	39.0	444.60	18.74	425.86	.2
N. of Soda & Meal	N. of Soda	13680	8052	58.8	40.4	42.8	483.12	22.34	460.78	.27
Amm. Sul. & Meal	Amm. Sul.	12558	7348	58.5	36.2	37.6	440.88	21.04	419.84	.2
C. S. Meal	N. of Soda	14676	8533	58.1	35.9	41.5	511.98	25.94	486.04	.2
				Average of 1927, 1928 and 1929						
N. of Soda	N. of Soda	12361	7835	63.5	39.8	46.1	470.10	18.28	451.82	.25
N. of Soda & Meal	N. of Soda	11659	7455	64.4	46.1	50.9	447.30	21.96	425.34	.2
Amm. Sul. & Meal	Amm. Sul.	11315	7166	63.6	51.3	51.7	429.96	21.66	408.30	.2
C. S. Meal	N. of Soda	12698	8344	66.3	45.1	52.6	500.64	27.64	473.00	.2

NITROGEN SOURCE AND SIDEDRESSING TEST (SPRING CROP)

This test, as given in Table No. 3, was conducted to determine the best nitrogen source and side-dressing combination for producing an early crop. Nitrate of soda or cottonseed meal as the nitrogen source, in the complete formula, when side-dressed with nitrate of soda, gave the best results. Cottonseed meal, when side-dressed with nitrate of soda, produced the highest net profit, $473.00, and the highest per cent of shipping tomatoes. Nitrate of soda as the original source, when side-dressed with nitrate of soda, produced a net profit of $451.82, and the average largest fruit. The fruit averaged better than one-quarter of a pound each in weight.

Table 4—Long Distance Shipping Test—1927, 1928 and 1929

tes of Applications:	Per cent of marketable fruit		
	On arrival	5 days later	10 days later
00 pounds per acre	96.4	94.7	88.3
00 pounds per acre	93.4	91.8	87.3
00 pounds per acre	97.7	94.0	87.7
00 pounds per acre	97.6	96.6	92.1

LONG-DISTANCE SHIPPING TEST

To meet the present day arguments that heavy applications of nitrate of soda injure the shipping and keeping quality of tomatoes, this test has been conducted. This test was carried on over a period of three years, in four series, and results given in Table No. 4 represent an average of all shipments for that period. The nitrate of soda was used in a 4-8-3 formula at the rate of 1000, 2000, 2500 and 3000 pounds per acre. Each year shipments were made from plots receiving these different applications in four-basket flat crates, by local express, to the Bureau of Agricultural Economics, U. S. D. A., New York City, for a careful and rigid inspection. The crates were marked so that the government inspectors did not know any of the details of the test, so an unbiased report could be obtained.

The results given are based on the percentage of the fruit from the different treatments that was firm and marketable (free from crate scars, shriveled or bruised fruit), on arrival, after five days in storage, and after ten days in storage.

All crates arrived in good condition and with a tight pack. It is evident that these tomatoes were subjected to a more severe treatment than they would have received in carlot shipments. Very few crate scars and few shriveled fruit were reported even when the fruit remained in storage for five-and-ten-day periods. The results indicate that the shipping and keeping quality of all the fruit was good and that even with the 2500 and 3000 pound applications the fruit shipped better and "held up" longer in storage than with the smaller applications.

Table 5—Nitrogen Source Test—Fall Crop, Main Station

Nitrogen sources:	Pounds per acre Total	Pounds per acre Shippers	Per-cent Ship-pers	Dollars per acre Total value @ 6c per pound	Dollars per acre Cost of ferti-lizer	Dollars per acre Net profit	Aver-age size per pound
1927							
(1500 pound application of a 4-8-3)							
Nitrate of Soda	12174	5134	42.3	308.00	20.63	288.00	.234
Ammonium Sulphate	11553	6287	54.4	377.00	17.39	360.00	.307
Combination	10476	7345	70.1	440.00	19.38	411.00	.385
C. S. Meal	11016	5831	52.0	349.00	20.16	329.00	.288
(2000 pound application of a 4-8-3)							
Nitrate of Soda	9717	4750	49.9	285.00	27.49	258.00	.250
Ammonium Sulphate	8515	3592	42.1	215.00	23.20	192.00	.246
Combination	9864	4574	46.3	274.00	25.84	249.00	.249
Cottonseed Meal	10517	4911	46.6	294.00	26.87	268.00	.241
1928							
(1500 pound application of a 4-8-3)							
Nitrate of Soda	13299	8510	63.9	510.60	20.63	489.97	.249
Ammonium Sulphate	14537	9744	67.0	584.64	17.39	567.25	.258
Combination	13165	7683	58.3	460.98	19.38	441.60	.262
Cottonseed Meal	13076	7679	58.7	460.92	20.16	440.76	.277
(2000 pound application of a 4-8-3)							
Nitrate of Soda	13523	7671	56.7	460.26	27.49	432.76	.279
Ammonium Sulphate	12807	7546	58.8	452.76	23.20	429.56	.240
Combination	12570	7368	58.6	442.08	25.84	416.24	.263
Cottonseed Meal	11207	7154	63.8	429.24	26.87	402.37	.280
Average 1927 and 1928							
(1500 pound application of a 4-8-3)							
Nitrate of Soda	12737	6822	53.1	409.32	19.96	389.36	.242
Ammonium Sulphate	13045	8016	60.7	480.96	18.40	462.56	.283
Combination	11821	7514	64.2	450.84	24.10	426.74	.324
Cottonseed Meal	12046	6755	55.4	405.30	34.00	371.30	.283
(2000 pound application of a 4-8-3)							
Nitrate of Soda	11620	6211	53.3	372.66	26.60	346.06	.265
Ammonium Sulphate	10661	5569	50.2	334.14	24.52	309.62	.248
Combination	11217	5971	52.5	358.26	32.12	326.14	.256
Cottonseed Meal	10862	6033	55.2	361.98	45.32	316.66	.261

NITROGEN SOURCE TEST (FALL CROP)

As given in Table No. 5, the above test was conducted to determine which nitrogen source in a complete fertilizer analysis would produce the largest quantity of shipping tomatoes, the highest quality and the greatest net profit.

In the 1500 pound application, ammonium sulphate gave the best results, producing 8016 pounds of marketable fruit, with a net profit per acre above the cost of the fertilizer of $462.56. The combination

and nitrate of soda sources gave the next best results, respectively. The combination source produced by far the largest average sized fruits, averaging .324 pounds each. This source also produced the highest per cent of shippers.

In the 2000 pound application, the nitrate of soda source led the test, producing 6211 pounds of shipping fruit at a net profit above the cost of fertilizer of $346.06, and the largest average fruit. The combination, cottonseed meal, and ammonium sulphate gave next best results, in the order named.

These results indicate that a 1500 pound application produces the maximum net profit per acre.

Table 6—Nitrate of Soda Rate Test—Fall Crop, Main Station

Rate of applications	Pounds per acre		Per cent	Dollars per acre			Average size
	Total	Shippers	shippers	Total value @ 6c per pound	Cost of fertz.	Net profit	per pound
			1927				
1000 lbs. per acre	9730	4401	45.2	264.00	13.72	251.00	.244
2500 lbs. per acre	8761	4034	46.0	242.00	34.35	208.00	.241
3000 lbs. per acre	8531	4036	47.3	242.00	41.24	201.00	.252
			1928				
1000 lbs. per acre	11502	6958	60.4	417.48	13.72	403.76	.270
2500 lbs. per acre	10224	5500	53.7	330.60	34.35	295.65	.262
3000 lbs. per acre	12115	7697	63.5	461.82	41.24	419.58	.283
			Average for 1928 and 1929				
1000 lbs. per acre	10994	5973	54.0	358.38	13.30	345.08	.234
2500 lbs. per acre	10567	5203	49.3	312.18	33.25	278.93	.275
3000 lbs. per acre	11102	6281	55.9	376.86	39.90	336.96	.288

NITRATE OF SODA RATE TEST (FALL CROP)

As given in Table No. 6, this test was conducted to determine the most profitable rate of application of a complete fertilizer using nitrate of soda as the nitrogen source; the effects of the heavy applications on the shipping and keeping quality of the fruit; and the influence of the rate of applications on fruit cracks and puffs.

The 1000 pound application produced the greatest net profit per acre. The 3000 pound application produced the largest yield of shipping tomatoes, the highest per cent of shippers, and the average largest fruit. The rate of application had no influence on fruit cracks and puffs. The effect of the different rates on the shipping and keeping quality of the fruit is given in the "Long-Distance Shipping Test."

Table 7—Nitrogen Source and Side-Dressing Test—Fall Crop, Main Station

(1000 pound application of a 4-8-3)

Nitrogen formula sources	200 lbs. Soda, (150 lbs. amm. sulphate) nitrogen side-dressing sources	Pounds per acre		Per cent	Dollars per acre			Average size per pound
		Total	Shippers	Shippers	Total value @ 6c per pound	Cost of fertilizer	Net profit	
			1927					
Nitrate of Soda	N. of Soda	9457	4836	51.1	290.00	19.72	271.00	.232
N. Soda & Meal	N. of Soda	8658	4248	49.0	254.00	19.56	235.00	.236
Amm. Sul. & Meal	Amm. Sul.	8193	4129	50.3	247.00	13.48	234.00	.237
Cottonseed Meal	N. of Soda	9200	4326	47.0	259.00	19.40	240.00	.232
			1928					
Nitrate of Soda	N. of Soda	10333	6273	60.7	376.38	19.72	356.66	.287
N. Soda & Meal	N. of Soda	9437	5345	56.6	320.70	19.56	301.14	.268
Amm. Sul. & Meal	Amm. Sul.	10627	6414	60.3	384.84	13.48	371.36	.279
Cottonseed Meal	N. of Soda	11030	6501	58.9	390.06	19.40	370.66	.248
			Average of 1927 and 1928					
Nitrate of Soda	N. of Soda	9895	5555	55.9	333.30	18.28	315.02	.260
N. Soda & Meal	N. of Soda	9048	4797	52.8	287.82	21.96	265.86	.252
Amm. Sul. & Meal	Amm. Sul.	9410	5272	55.3	316.32	21.66	294.66	.258
Cottonseed Meal	N. of Soda	10115	5414	53.0	324.84	27.64	297.20	.240

NITROGEN SOURCE AND SIDE-DRESSING TEST (FALL CROP)

As given in Table No. 7, this test was conducted to determine the best nitrogen source and side-dressing combination for producing the fall crop. Nitrate of soda and cottonseed meal as the sources, when side-dressed with nitrate of soda, respectively, were the leading combinations. Nitrate of soda, both as the formula and side-dressing source, proudced 5555 pounds of shipping tomatoes, 55.9 per cent shippers, the average largest fruit, and the greatest net profit per acre, $315.02.

These results indicate that nitrate of soda or cottonseed meal are good nitrogen sources to apply under the crop, and that nitrate of soda is a very good nitrogen carrier for side-dressing the crop.

Table 8—Comparative Costs, Availability and Percentages of Nitrogen

Nitrogen sources:	Per cent nitrogen	Cost: Average market price per ton	Cost: Actual nitrogen plant food per pound
Nitrate of Soda	15.0	$50.00	16.6c
Ammonium Sulphate	20.0	56.00	14.0c
Cottonseed Meal	6.5	45.00	34.6c
Combination	13.8	50.00	21.7c
½ N. Soda & ½ Meal	10.7	47.00	25.6c
½ Amm. Sul. & ½ Meal	13.2	50.00	24.3c
Urea	46.0	100.00	11.0c
Calurea	34.0	70.00	10.3c
Calcium Nitrate	15.0	50.00	16.6c

The above table consists of data showing the availability, the percentage of nitrogen carried by the different sources, the average market costs per ton, and the actual cost per pound of the nitrogenous plant food carried by the sources.

The comparative quickness in availability as given for the different sources is determined by the ability of each source to go into solution when in contact with moisture at 20 degrees Centigrade; for instance, nitrate of soda is the quickest acting, and 88 parts of it are soluble in 100 parts of water. Urea and ammonium sulphate are the next quickest available, respectively. The purpose of the combination sources is to provide available nitrogen plant food soon after the plants are set in the field and throughout the growing and fruiting season.

Urea and calurea cost the most per ton, but the percentage of nitrogen plant food carried is so high that it is the cheapest per pound. The nitrogen plant food from ammonium sulphate, nitrate of soda and calcium nitrate are the next cheapest per pound, respectively.

SUMMARY

In the 1500 pound application the leading source was composed of one-half nitrogen from nitrate of soda and one-half from cottonseed meal, for the spring crop.

In the 2000 pound application, the cottonseed meal was the leading source of nitrogen for the spring crop, and third in the fall crop.

The 2500 pound rate of application produced, outstandingly, a larger net profit and average larger fruit than the 1000 or 3000 pound rates.

Cottonseed meal as the source under the crop, when side-dressed with nitrate of soda, proved to be the leading combination for the spring crop, and second best in the fall crop.

A combination source composed of equal quantities of nitrogen from nitrate of soda, ammonium sulphate, and cottonseed meal gave second best results in both spring and fall crops.

Heavy or light applications appeared not to affect or influence cracking or puffy fruit.

Nitrate of soda under the crop, side-dressed with nitrate of soda, produced the largest average fruits and ranked second in net profit in the side-dressing tests.

In the 1500 pound application, ammonium sulphate gave best results with the fall crop, and lowest in the spring, for a three year average.

In the 2000 pound application sulphate of ammonia was lowest in fall crops and next lowest in spring crops.

Nitrate of soda ranked third in the 1500 pound application, both in spring and fall crops. In the 2000 pound application, nitrate of soda

ranked 1st in net profit and average largest fruits in the fall crop, and second in the spring crop.

In the rate test, 2500 pounds per acre was first in the spring crop and the 1000 application was first in the fall crop.

The 3000 pound application produced the largest yield of shippers and the average largest fruit, but due to cost of material, was second in net profit.

The results of the long-distance shipping test indicate that nitrate of soda (when used in a complete formula) even in 2500 and 3000 pound applications was not in the least injurious to the shipping and keeping qualities of the fruit. The tomatoes from the heavy treatments shipped and kept better in storage than those from lighter applications.

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REPORT

OF THE

SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION

By

W. R. PERKINS, W. S. ANDERSON AND
W. W. WELBORNE

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. COLLEGE, MISSISSIPPI
J. R. RICKS, Director

ANNUAL REPORT

OF THE

SOUTH MISSISSIPPI EXPERIMENT STATION

By

W. R. PERKINS, W. S. ANDERSON, W. W. WELBORNE

The field crop experiments at the South Mississippi Experiment Station in 1929 were almost identical with those of 1928 and dealt mainly with cotton production, which included varieties, fertilizers, character and amounts per acre, effect of fertilizers on rust and wilt and boll weevil control. The horticultural experiments being largely in perennial crops, were the same except for the few experiments with potatoes and beans and strawberries.

On the whole, the year 1929 was very favorable to crop production on the farm of this station. While rainfall, practically 70 inches for the year, was a little in excess of the average, it was uniformly distributed throughout the year. A few heavy rains in February and March did some damage to the early planted truck crops but did not damage field crops except to have washed the land considerably. A rainy spell in July continuing throughout the whole month and during which time 22 days were recorded as having had more or less rain and no more than two days at any one time were without rain. Consequently July was admirable for the multiplication of the boll weevil and the crops throughout the country on that account were very materially damaged by the weevil. The cotton crop at the station had been poisoned 4 or 5 times up to early in the month of July, and the poisoning was continued between rains until the middle of the month, when the breaking down of our dusting machine forced us to abandon further poisoning. Yet at the end of the year, we had picked a little more than a bale of cotton per acre from the fertilized plats of the field, having gathered 28 bales from between 29 and 30 acres, about 1/5 of it being unfertilized or worked as check plats.

The weather was also favorable for corn and this whole section has possibly more corn than at any previous year on record. The station produced right around 1500 bushels on slightly more than

50 acres and grew a magnificent crop of soybeans with each row of corn.

On the night of September 25, fire destroyed the station barn and contents. The loss was four mules, two horses, all harness, wagons, farm implements and machinery including two tractors, threshing machine, binder and two cotton dusters, valued at more than $200 each; 1,000 bushels of corn was also lost and six bales of cotton. In addition we lost all of the soybean seed of the different varieties that we had saved, all of the cowpea seed and other legume seed we had put away for the 1930 plantings. Fortunately we had two cribs of corn elsewhere and another barn full of hay, which will enable us to get by without the purchasing of feed. To enable us to carry on, the Governor took steps at once to get permission from the Legislature to furnish us $15,000 to replace the barns and livestock. To replace everything new will require more money, but we will be in very fair shape when this $15,000 is spent. We can only surmise that the origin of the fire was from a spark smoldering in some freshly ginned bales of cotton, which were placed in the barn the afternoon before the fire.

In conducting the work of the station, we have in mind, **First,** the determination as far as possible of unknown facts in regard to crops, soils, fertilizers, to be published for the benefit of the farmers of the State, and supplemental to results already obtained at this and other stations. **Second,** and by no means, we think, of least importance, to so conduct the work that it may serve as demonstrations on how to grow these crops and handle them in a profitable manner. We feel that the production of 26 bales of cotton on less than 26 acres of land attracted more attention than did any other feature of the work on the place in 1929. The growing of soybeans in rows of corn also proved a very valuable demonstration. We hope to so conduct the work that farmers or others who visit the station may get some valuable information or suggestions at least as to how they may improve their farming.

During the summer hundreds of farmers visited the station in groups and singly. We are always glad to have them and extend an invitation to everyone interested to visit the station and inspect the work.

WINTER COVER CROPS

Immediately after the harvesting of the crops in the fall, we sowed oats on practically all of our land. In the fall of 1928 we

planted Hairy Vetch and oats on approximately 10 acres of land and in a field adjoining the field planted to oats and Hairy Vetch, we planted Austrian winter peas and oats on approximately 20 acres of land. The Austrian winter peas and Hairy Vetch did not get up to any size, but we had a fine crop of oats to turn under in the spring. Had the Austrian peas and the Hairy Vetch seed been inoculated before planting instead of inoculating the soil after planting, we would have probably gotten a much better growth.

SUGAR CANE

In the year of 1925 a variety test of Mosaic resistant sugar cane was started here. In the year 1927, the division of sugar plant investigations, U. S. Dept. of Agriculture, agreed to put on a cooperative experiment at this station in the growing of such canes. This has brought our test up to 44 varieties. Up to this time the department has only released four varieties, namely: Cayana, P. O. J. 213, 234, and 36. The P. O. J. 213 and Cayana cane was distributed to farmers in South Mississippi counties from Lauderdale county to the Coast, approximately 12,000 stalks of Cayana was distributed and 6,000 stalks of P. O. J. 213. Between 300 and 400 stalks of nine varieties each was made up into syrup separately. We did this in order to find out something about the quality of the syrup. The four leading varieties were P. O. J. 36M, P. O. J. 213, P. O. J. 979, and Cayana.

Sugar Cane—Showing Growth on Two Rows of Purple, on Right, and Ribbon Cane on Left, Compared with P. O. J. Varieties.

WINTER LEGUMES

On six 1/10 acre plats, we planted six winter legumes, namely: Monantha vetch, Austrian winter peas, Pearl vetch, Woolly vetch, Hairy vetch and Black Purple vetch. The date of planting these legumes was on October 29, 1928, which was later than they should have been planted to have gotten the best result. There was a perfect stand obtained on all the plats with the exception of the Monantha vetch. In the latter part of March the plant lice were extremely bad on the Austrian Winter pea, Hairy vetch, and the Black Purple vetch. The plant lice did not damage the Pearl vetch, and Woolly vetch to any great extent, and due to this we obtained a few seed from each.

SOYBEAN VARIETY TEST

In this test we used 14 varieties of soybeans all of which were sent here from the Delta Branch Experiment Station. These varieties were planted on May 9, in three row plats. On April 19, the land was fertilized at the rate of 400 pounds per acre of a 4-8-4 home mixed fertilizer. Seven of the 14 varieties were cut, cured and weighed. The seven varieties cut for hay are as follows, calculated in pounds per acre; Laredo 4,800 lbs.; Otootan 6,360 lbs.; Delta 488, 4640 lbs.; Laxitan 7440 lbs.; Tanlaxi 8,400 lbs.; Tokio 6,960 lbs., and Biloxi 8,880 lbs. The other seven varieties used in this test are as follows: Delta 6,679; Delta 6,676; U. S. D. A. 46,687; U. S. D. A. 36,906-9x10; George Washington; Midwest, and Mammoth Yellow.

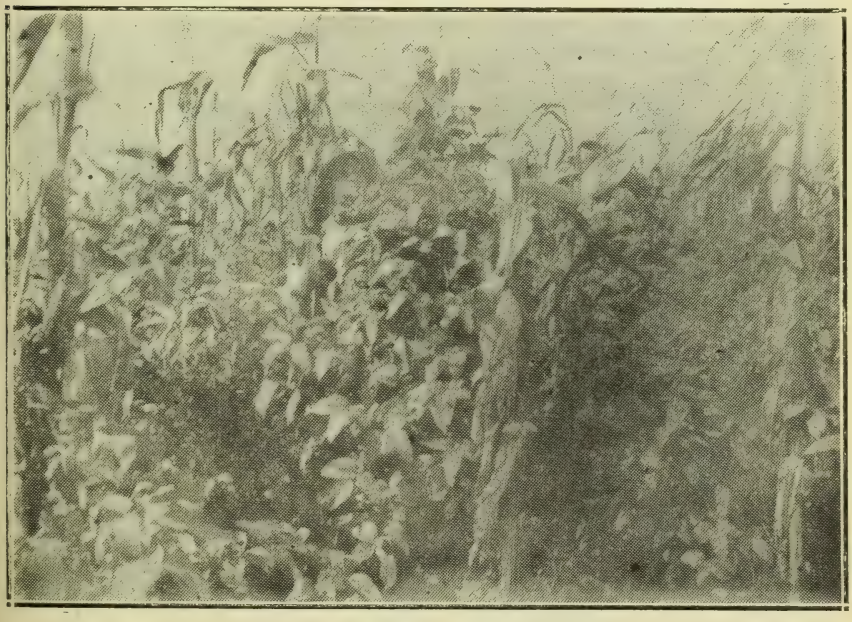
CORN AND BILOXI SOY BEANS

Due to approximately 40 acres of our poorest land, too rolling for experimental work, we planted this in corn and Biloxi soybeans. In the early part of January this land was disced well with a Farmall Tractor and in February the rows were laid off approximately five feet apart. This land was fertilized at the rate of 400 lbs. per acre of a 4-8-4 fertilizer, and planted about the middle of March. In planting the corn and soybeans, we used a duplex planter, planting the corn three feet apart, with a hill of soybeans between each hill of corn. In the latter part of May this corn was side dressed with approximately 100 lbs. of nitrate of soda and other various sources of nitrogen, as we had small amounts of remnants on hand. All of this corn was harvested which made between 25 and 30 bushels per acre. A good

many of the soybeans were harvested for seed. We had published in the local paper that anyone who wanted soybean seed could get them by coming here and harvesting them without any charge.

CORN AND NEW STRAINS OF BILOXI SOYBEANS

Approximately ten acres of land on the Main Station, which was too rolling for experimental purposes, was planted to corn and new strains of Biloxi soybeans, namely: Biloxi Strains No. 40, 61, and 108. This land was prepared and laid off in rows approximately 3½ feet apart and fertilizer applied at the rate of 400 pounds per acre of a 4-8-4, which was applied about the tenth of March. Corn and soybeans were planted the latter part of March, using a Duplex planter, which planted the corn three feet apart and a hill of soybeans between each hill of corn. There was approximately 100 lbs. of nitrate of soda applied the latter part of May as a side dressing. The average yield per acre of corn was 40 bushels. Seed was harvested from each of the new strains of Biloxi beans. Strain No. 40 is an upright growing bean with a medium size stem, and grows to be approximately four feet high. Strain No. 61 is an upright bean with a very



Biloxi Soybeans in Corn—Strain No. 61

large stem, which grows to be seven and eight feet high. Strain No. 108 is a running bean with small stem which makes excellent hay. This bean does not start running until the corn is in full tassel and silk.

TABLE No. 1

Nitrogen Analysis Test—Cotton—1929—Boyd Smith Field

Treatment per Acre		Pounds Seed Cotton per Acre		
Pounds	Analysis	Plot Yield	Check Yield	Increase
800	0-8-4	777		
800	4-8-4	1260	799	461
800	6-8-4	1492	821	671
800	8-8-4	1662	843	819
800	10-8-4	1680	865	815
800	0-8-4	888		

NITROGEN ANALYSIS TEST

For two successive years, this fertilizer test has been conducted on the same plats. There are thirty-four 1/20 acre plats used in this test, which gives six replications for each analysis used. The basis of the fertilizer used uniformly over the 34 plats was 800 lbs. per acre of an 0-8-4 fertilizer to which was added the correct amount of nitrogen wherever nitrogen was due. The percentage of nitrogen varied from 4% to 10%, using nitrate of soda as the source of nitrogen. D. & P. L. 5242A-310-46 cotton seed was the variety used, which was planted April 22. Table No. 1 gives the result of this work in detail.

This test, we consider, almost perfect for a good grade of level hill land.

Left, 600 Pounds 8-8-4; Yield, 1662 Pounds. Right, 600 Pounds 0-8-4; Yield, 832 Pounds.

800 pounds of 6-8-4 or 8-8-4 has given splendid results. While potash has not in most instances given outstanding results we believe on the whole that moderate applications have yielded a profit and all things considered, we would recommend 4% of potash in all cotton fertilizers.

TABLE No. 2
Old Fertilizer Test—Neal Field—1929

Pounds Material per Acre			Lbs. Seed Cotton per Acre	
Nitrate Soda	Superphosphate	Muriate Potash	Plot Yield	% Wilt Infestation
200	400	0	1269	45.8
	check		342	21
200	400	50	1458	17.6
200	400	100	1728	2.6
	check		459	25.8
200	400	150	1692	4.3

OLD FERTILIZER TEST WITH COTTON

In 1919 this fertilizer test was started, using twelve 1/12 acre plats, with no duplications of any of the fertilizer. In 1924 and 1925 these plats were planted to sweet potatoes, and in 1926 were planted to corn. Due to the topography of the land we had to discontinue six of the plats, using only six of the original 12 plats. For the past 11 years these plats have received the same quantities of nitrogen, superphosphate and potash when fertilized. The fertilizer was applied on March 29, and planted to D. & P. L. 5242A-310-46 cotton seed on April 23. Table 2 gives the result of this test in detail. The percentage wilt infestation shows a decided influence where potash was used.

TABLE No. 3
Potash Analysis Test—Boyd Smith Field—1929

Lbs. per Acre	Analysis	Pounds Seed Cotton per Acre		
		Yield per Acre	Check Yield	Increase
800	6-8-0	1327		
800	6-8-4	1330	1326	4
800	6-8-8	1320	1324	—4
800	6-8-10	1375	1322	53
800	6-8-0	1320		
800	6-8-12	1290	1280	10
800	6-8-14	1415	1240	175
800	6-8-0	1200		

POTASH ANALYSIS TEST

The purpose of this test is to find out the amount of potash needed on this type of soil which will give the best control on cotton wilt. In this test there was 21 1/20 acre plats with various analyses used. The percentage of potash used ranged from 6-8-0, which was used as a check, up as high as a 6-8-14. The percentage of nitrogen and of superphosphate was the same on every plat. These plats were fertilized at the rate of 800

lbs. per acre, which was applied April 2. This test has been conducted on the same land for two successive years, and in the two years of experiment the soil was inoculated with wilt culture prior to planting to be sure that the wilt was present in the soil.

The variety of cotton planted was D. & P. L. 5242A-310-46, which was planted on April 19. Due to this variety of cotton being a wilt resistant variety we did not get any data on the percentage of wilt. Table No. 3 gives the results of this test, each being the averages of triplicate test.

TABLE No. 4
Potash Sources Test—Boyd Smith Field—1929

Lbs. Applied per Acre	Analysis	Sources	Pounds Seed Cotton per Acre		
			Yield per A.	Check Yield	Increase
800	6-8-0		1470		
800	6-8-4	KCL	1535	1468	67
800	6-8-4	K_2SO_4	1535	1466	69
800	6-8-4	Kainit	1500	1464	36
800	6-8-4	D. M. S.	1430	1462	—32
800	6-8-0		1460		

POTASH SOURCES TEST

On this test there were only four sources of potash included, these sources being muriate of potash, potassium sulphate, kainit, and sulphate potash of magnesia. There were seventeen 1/20 acre plats in this test, each plat fertilized uniformly with a 6-8-0 fertilizer at the rate of 800 lbs. per acre and 32 lbs. per acre of actual potash applied from the sources of each. This experiment has been conducted on the same land for two successive years.

The fertilizer was applied on April 2, and D. & P. L. 5242A-310-46 cotton planted on April 22. Table No. 4 gives the results of this work in detail.

TABLE No. 5
Potash Sources Under Cotton—Moody Field—1929

Treatment per Acre			Pounds Seed Cotton per Acre			
Lbs. per Acre	Analysis	Sources	Yield per Acre	Check Yield	Increase	% Wilt Infestation
800	4-8-0		1045			13.7
800	4-8-4	Pot. Sul.	1415	1077	338	8.1
800	4-8-4	Muriate	1330	1110	220	5.4
800	4-8-4	Kainit	1300	1142	158	5.6
800	4-8-4	D. M. S.	1330	1175	155	7.8
800	4-8-4	Trona	1275	1207	68	9.3
800	4-8-0		1240			11.2

POTASH SOURCES UNDER COTTON—MOODY FIELD

This fertilizer test has been conducted on the same land for five successive years, testing five sources of potash under cotton. In this test, there are twenty-four 1/20 acre plats used, all plats being fertilized uniformly with a 4-8-0 fertilizer at the rate of 800 lbs. per acre, and 32 pounds

per acre of actual potash applied from the several sources of each of three plats receiving it. This fertilizer was applied April 10, D. & P. L. 5242A-310-46 cotton was planted April 25. Table No. 5 gives the results of this work in detail, each result reported being the average of triplicate test.

TABLE No. 6

Effect of Potash Fertilizer on Wilt—Neal Field—1929

Treatment per Acre			Lbs. Seed Cotton per A.
Lbs. Fert. per A.	Analysis	Source of Potash	Yield Per A.
No fertilizer			1065.5
600	6-8-0		1847.5
600	6-8-8	KCL	1616
600	6-8-8	K_2SO_4	1585.5
600	6-8-8	D. M. S.	1899
600	6-8-8	Kainit	1842.5
600	6-8-4	KCL	1837
600	6-8-10	KCL	1753.5
600	6-8-12	KCL	1811

EFFECTS OF POTASH FERTILIZER ON COTTON WILT

In the year 1919, fifty-six 1/12 acre plats were laid off for this test. Due to the topography of the land, we discontinued this work on 28 plats heretofore used, and in order to continue this work we had to discontinue the soil fertility work which adjoined the potash work on cotton and start this work there. Due to this change, we are having to publish an additional table. With the exception of four unfertilized plats, a basic mixture of an 4-8-0 fertilizer at the rate of 600 lbs. per acre was applied, to which was added potash from various sources running from 4% to 12%, and muriate of potash was the source of potash used when the percentage was varied, when the source of potash was used a fertilizer containing 8% was always used. Table No. 6 gives the results of this work on the 28 plats where the soil fertility work has been in test for several years and the results are not just what we might expect, due to the fact that all the plats heretofore used had a basic mixture in 1928 of 400 lbs. per acre of a 4-8-4 fertilizer.

TABLE No. 7

Effect of Potash Fertilizer on Wilt—Neal Field—1929

Treatment per Acre			Lbs. Seed Cotton per A.
Lbs. Fert. per A.	Analysis	Source of Potash	Plot Yield
No fertilizer			297
600	6-8-0		966
600	6-8-8	KCL	1416
600	6-8-8	K_2SO_4	1791
600	6-8-8	D. M. Salt	1836
600	6-8-8	Kainit	1539
600	6-8-4	KCL	1431
600	6-8-10	KCL	864
600	6-8-12	KCL	864

Table No. 7 gives the result of this work in detail, which is a replication of the fertilizers that we used in Table No. 6. This fertilizer test has been conducted on the same land for eleven successive years. At the end of the growing season plats without potash showed up the need of this material decidedly. The time of applying the fertilizer and time of planting was the same as the above.

TABLE No. 8

Effect of Potash Fertilizers on Wilt—Neal Field—1929

Treatment per Acre		Pounds Seed Cotton per Acre		
Lbs. Barnyard Manure	Lbs. Fert. per Acre	Analysis	Source of Potash	Plot Yield
8.6 tons	No fertilizer			1521
8.6 tons	600	6-8-0		2056.5
8.6 tons	600	6-8-8	KCL	1953
8.6 tons	600	6-8-8	K_2SO_4	2340
8.6 tons	600	6-8-8	D. Manure Salt	1962
8.6 tons	600	6-8-8	Kainit	1926
8.6 tons	600	6-8-4	KCL	1584
8.6 tons	600	6-8-10	KCL	1710
8.6 tons	600	6-8-12	KCL	1584

Table No. 8 gives the results in detail on another series of plats, the same as mentioned in the above paragraph, and in the two tables. This same fertilizer test was conducted on land that had been used in potash work for eleven successive years. In the year 1928, and 1929, barnyard manure was applied on each plot at the rate of 8.6 tons per acre. With the exception of the plots fertilized with barnyard manure, all plats were fertilzed, planted, cultivated, and poisoned in the same way. The fertilizer was applied on all the above three tests mentioned on March 29, and D. & P. L. 5242A-310-46 cotton seed was planted on April 23. We did not get any data as to the percent of wilt in this fertilizer test, as there was no wilt present. The variety of cotton planted was a wilt resistant variety.

TABLE No. 9

Additional Top Dressing with Muriate of Potash—1929

Lbs. per A.	Analysis	Additional Amount of Potash Added	Pounds Seed Cotton per Acre		
			Plot Yield	Check Yield	Increase
Check			1575		
800	6-8-4	50	1405	1530	—125
800	6-8-4	100	1440	1485	—45
800	6-8-4	150	1395	1440	—45
Check			1395		
800	6-8-4	200	1400	1422	—22
800	6-8-4	250	1555	1449	106
Check			1477		

ADDITIONAL TOP DRESSING WITH MURIATE OF POTASH

In this test, which has been conducted on the same land for two successive years there were twenty-one 1/20 acre plats used. The basis of the fertilizer used uniformly on these plats was at the rate of 800 lbs. per acre of a 6-8-4 home mixed fertilizer, using as the mixture, nitrate of soda, superphosphate, and muriate of potash. This fertilizer was applied on April 2. The additional amount of muriate of potash was applied as a side dressing on June 13, ranging from 50 lbs. per acre up to 250 lbs. per acre.

Due to no wilt showing up on this test, we did not make any wilt counts. The variety of cotton planted was D. & P. L. 5242A-310-46, which was planted April 19. Table No. 9 gives the average results of this work, the averages being triplicate tests in each instance.

TABLE No. 10

Organic Mercury Treatment for Cotton—Boyd Smith Field—1929

Organic Mercury Used	Lbs. Fert. Used	Analysis	Pounds Seed Cotton per Acre			% Germination	% Damping Off	% Wilt Infestation
			Plot Yield	Check Yield	Increase			
Check	600	6-8-4	1295			62	10.9	16.2
Corona Merko	600	6-8-4	1290	1285	5	58.4	12	14
Special Bayer	600	6-8-4	1237	1275	—38	58.8	10.6	13
Semesan	600	6-8-4	1207	1265	—58	71.2	10.7	13.2
Check	600	6-8-4	1256			66	10.4	16
Semesan, Jr.	600	6-8-4	1275	1235	40	71.8	10.9	11.2
Ceresan	600	6-8-4	1226	1215	11	73.4	13.4	9.2
Iodine Bentomite	600	6-8-4	1185	1194	—9	82.4	10.9	14.2
Check	600	8-8-4	1174			73	10.4	17.2
Iodine Keiselguhr	600	6-8-4	1215	1183	32	66.6	10.8	13
K. I. X.	600	6-8-4	1185	1192	—7	68.2	10.2	12
P. M. A.	600	6-8-4	1196	1201	—5	72	10.5	14.5
Iodine Fuller Earth	600	6-8-4	1222	1210	12	74	11	14.5
Check	600	6-8-4	1219			66.4	11.1	14.5

SEED TREATMENT TEST

On this experiment we are testing out different organic mercury compounds for the control of "Damping-off" and also for the control of cotton wilt. In this test we used 10 different organic mercury compounds. The cotton seed were treated according to Dr. L. E. Miles, Plant Pathologist of A. & M. College, instructions. The variety treated and planted was D. & P. L. 5242A-310-46, using single rows in our test. Every fourth row was a check row, on which untreated seed were planted. There were seven replications in this test. On the seventh replication the seed were planted by hand, placing only five seed in a hill,

every 12 inches apart. The basis of the fertilizer used uniformly on this test was 600 pounds per acre of a 6-8-4 fertilizer. Table No. 10 gives the results of this work in detail.

TABLE No. 11
Nitrogen Sources Test—Cotton—Boyd Smith Field—1929

Lbs. per A.	Analysis	Sources of Nitrogen	Pounds Seed Cotton per Acre		
			Plot Yield	Check Yield	Increase
600	0-8-4		570		
600	6-8-4	Nitrate Soda	1226	629	597
600	6-8-4	Ammonium Sul.	1099	688	411
600	6-8-4	Cal. Cyanamid	1091	747	344
600	0-8-4		805		
600	6-8-4	Cal. Nitrate	1165	797	368
600	6-8-4	Urea	1045	789	256
600	6-8-4	Cal. Urea	1075	781	294
600	6-8-4	Leunasalpeter	1085	773	312
600	0-8-4		765		

NITROGEN SOURCES TEST ON COTTON

Thirty-four 1/20 acre plats were used in this test, testing seven different sources of nitrogen. Each plat was fertilized uniformly, using 600 lbs. per acre of a 0-8-4 fertilizer and 6% nitrogen, or 36 lbs. of actual nitrogen applied from the seven sources to each plat receiving it. The fertilizer was applied on April 9, and D. & P. L. 5242A-310-46 was planted on April 20. Each plat received the same seed bed preparation, cultivation, and poisoning. Table No. 11 gives the result in detail.

TABLE No. 12
Organic Nitrogen Sources Test—Cotton—K. Smith Field—1929

Treatment per Acre		Sources of Nitrogen	Pounds Seed Cotton per Acre		
Lbs. per A.	Analysis		Plot Yield	Check Yield	Increase
600	0-8-4		1240		
600	4-8-4	Dried Blood	1855	1228	627
600	4-8-4	Fish Scrap	1670	1217	453
600	4-8-4	Tankage	1660	1206	454
600	0-8-4		1195		
600	4-8-4	½ Fish Scrap ½ $NANO_3$	1650	1225	425
600	4-8-4	½ Tankage ½ $NANO_3$	1730	1255	475
600	4-8-4	Cal. Nitrate	1780	1285	495
600	0-8-4		1315		

ORGANIC NITROGEN SOURCES TEST

On twenty-five 1/20 acre plats different sources of organic nitrogen was used in addition to nitrate of soda. All plats received the equivalent of 600

lbs. per acre of a 0-8-4 fertilizer and 24 lbs. of actual nitrogen applied from the several sources to each plat receiving it. The fertilizer was applied on April 13, and planted on April 23, to D. & P. L. 5242A-310-46 cotton seed. Table No. 12 gives the result of this work in detail. The figures given being the averages of triplicate test in each instance.

TABLE No. 13

Nitrogen Sources Side Dressing—Cotton—Anderson Field—1929

Lbs. Material per Acre at Planting	Analysis	Sources	Lbs. Actual Nitrogen per Acre	Lbs. S'd Cotton per A.		
				Plot Yield	Check Yield	Increase
600 factory mixed	4-8-4	Check		727		
600 factory mixed	4-8-4	Nit. Soda	22½	1098	715	383
600 factory mixed	4-8-4	Synthetic Nit.	22½	985	704	281
600 factory mixed	4-8-4	Cal. Nitrate	22½	826	692	134
600 factory mixed	4-8-4	Cal. Cyanamid	22½	712	681	31
600 factory mixed	4-8-4	Cal. Nitro	22½	848	670	178
600 factory mixed	4-8-4	Check		659		
600 factory mixed	4-8-4	Ammonia Sul.	22½	689	656	33
600 factory mixed	4-8-4	Liquid Am.	22½	612	654	—42
600 factory mixed	4-8-4	Cal. Urea	22½	780	651	129
600 factory mixed	4-8-4	Urea	22½	742	649	93
600 factory mixed	4-8-4	Leunasalpeter	22½	803	646	157
600 factory mixed	4-8-4	Check		644		

NITROGEN SOURCES SIDE DRESSING OF COTTON

There were twenty-five 1/22 acre plats used in this test, using only two replications of each source of nitrogen. The factory mixed fertilizer 4-8-4 was applied April 23, at the rate of 600 lbs. per acre. The several sources of nitrogen was applied as a side dressing on June 12. This was applied at the rate of 22½ lbs. of actual nitrogen to the acre. D. & P. L. 5242A-310-46 cotton seed was planted April 27. Table No. 13 gives the result of the work in detail.

TABLE No. 14

Superphosphate (Acid Phosphate) vs. Rhum's Phosphate—Cotton—Boyd Smith Field—1929

Pounds Material Applied per Acre				Pounds Seed Cotton per Acre		
Nitrate Soda	Rhum's Phos.	Super. Phos.	Muriate Potash	Plot Yield	Check Yield	Increase by Rhum's Phosphate
160		300	50	1125		
160	300		50	1372	1124	248
160	400		50	1210	1122	88
160	600		50	1170	1121	49
160		300	50	1120		

SUPERPHOSPHATE vs. RHUM'S PHOSPHATE

In this test, three replications were used making the sum of fifteen 1/20 acre plats. All plats receiving the equivalent of 600 pounds per acre of a 4-0-4 fertilizer, with the additional amount of superphosphate to bring the analysis up to 8%. The 4-8-4 fertilizer using superphosphate, was a check plat. The Rhum's phosphate was added at the rate of 300, 400 and 600 lbs. per acre to the 4-0-4 mixture. This work has been conducted on the same land for two successive years, and in the two years the 300 pounds of Rhum's gave the largest increase over the check.

The fertilizer was applied April 3, and planted April 19, to D. & P. L. 5242A-310-46 cotton seed. Table No. 14 gives the result of this work in detail.

TABLE No. 15

Factory vs. Home Mixed—Cotton—K. Smith Field—1929

Material Applied per Acre		Analysis	Pounds Seed Cotton per Acre		
Factory Mixed	Home Mixed		Plot Yield	Check Yield	Increase
No fertilizer			912		
600 (Factory)		4-8-4	1735	939	796
	600	4-8-4	1855	967	888
600 (Plant food)		4-8-4	1872	994	878
No fertilizer			1022		

FACTORY vs. HOME MIXED FERTILIZER—COTTON

In this test there are twenty-five 1/20 acre plats, making a total of six replications of each fertilizer used. We only used three different fertilizers, namely, Home mixed 4-8-4, Meridian factory mixed 4-8-4, and Plant food factory mixed 4-8-4. The Home mixed 4-8-4 was made by mixing nitrate of soda, superphosphate, and muriate of Potash in the proper proportions to furnish the same amount of plant food as would be supplied by the factory mixed fertilizers. This fertilizer was applied on April 13, at the rate of 600 pounds per acre. D. & P. L. 5242A-310-46 cotton seed was planted on April 23. Table No. 15 gives the result of this work in detail.

TABLE No. 16

Factory High vs. Low Analysis Fertilizers—Cotton—K. Smith Field—1929

Lbs. Material Applied per Acre	Analysis	Lbs. Seed Cotton per Acre
		Plot Yield
600	4-8-4	1297
160	15-30-15	1197
600	3-9-3	1332
200	9-27-9	1194

HIGH vs. LOW ANALYSIS FERTILIZER

On this test, we did not compare the home mixed low analysis fertilizer with the high analysis as heretofore used. This work was conducted on

twenty-one 1/20 acre plats, making a total of five replications of each fertilizer used. In comparing the low analysis and the high analysis fertilizer, we used 600 pounds of a 4-8-4 in comparison with 160 pounds of a 15-30-15. On the 3-9-3 fertilizer we used 600 pounds in comparison with 200 pounds of a 9-27-9. This fertilizer was applied on April 23, and D. & P. L. 5242A-310-46 cotton seed was planted on April 23. Table No. 16 gives the result of this work in detail.

TABLE No. 17
Cotton Variety Test—Anderson Field—1929

Variety	Lbs. per Acre		Lint Data			$ per Acre Total	Rank Value	% Wilt
	Seed Cotton	Lint	%	Lgth.	Cents per Lb			
Cleveland 54	1105	403.3	36.5	1	18.70	85.95	2	3.5
Cleveland Coker	786	279	35.5	1 1/32	19.15	61.03	13	16.5
Wilson Type	1118	384.6	34.4	15/16	17.85	79.65	4	4
Cleveland Pied.	1116	399.5	35.8	29/32	17.60	81.06	3	2
Half & Half	737	303.6	41.2	27/32	16.50	56.59	16	24.5
Cook 1010	536	221.3	41.3	7/8	17.35	43.12	20	29.5
Acala 37	876	297.8	34.0	1 1/16	19.30	66.14	10	16.5
D. & P. L. 4-8	768	302.6	39.4	1 1/32	19.15	64.93	11	14
Miller 3286	930	327.3	35.2	1 1/32	19.15	71.72	7	3
Miller 589	945	345.8	36.6	1 1/32	19.15	75.21	6	6.5
Deltatype Webber	379	114 8	30.3	1 3/16	20.55	27.55	23	67.5
Delfos 910	812	267.9	33.0	1 5/32	19.95	61.72	12	23.5
Missdel No. 1	546	181.8	33.3	1 5/32	19.95	41.73	22	31.5
Delfos 0602	722	236	32.7	1 5/32	19.95	54 36	17	21
Missdel No. 2	626	220.9	35.3	1 5/32	19.95	50.15	18	36
Delfos 811	551	185.1	33.6	1 5/32	19.95	42.42	21	47.5
D. & P. L. No. 6	1084	390.2	36.0	1 1/8	19.70	87.28	1	4.5
Express 121	898	317	35.3	1 3/32	19.35	70.05	8	12
ExpressLightning	1022	339.3	33.2	1 5/32	19.95	77.93	5	1
Stoneville No. 1	745	268.9	36.1	1 1/16	19.30	59.04	15	10.5
Stoneville No. 2	831	301.6	36.3	1 1/16	19.30	66.15	9	13
Lonestar 284	611	220	36.0	1 3/32	19.35	48.43	19	22
Lonestar 561	752	277.4	36.9	1 1/32	19.15	60.24	14	12.5

COTTON VARIETY TEST

For this year the variety test conducted here included 41 varieties some of which are new varieties and new strains of varieties. The low yields reported in these tests were caused by soil being badly infested with wilt, due to seasonal conditions from the fifteenth of July until the first of August; and the lack of a sufficient amount of fertilizer on this particular type of soil, which is of the Ruston Fine Sandy Loam. This land was fertilized at the rate of 600 lbs. per acre of a 4-8-4 fertilizer. From all indications there should have been 800 lbs. per acre of a 6-8-4

TABLE No. 18

Eight Additional Varieties of Cotton—Anderson Field—1929

Variety	Pounds per Acre		Lint Data					
	Seed Cotton	Lint	% Lint	Lgth	Cents per Lb.	$ per Acre	Rank in Value	% Wilt
Coker Cleve. 5 Str. 2	818	309.2	37.8	1	18.70	65.45	5	9½	27.5
Coker Pedi. Super Seven Str. 5	1010.5	352.7	34.9	1 1/32	19.15	77.41	1	5½	.5
Coker Clev. 884 Str. 2	891	316.3	35.5	1 1/16	19.30	69.67	3	8½	17
Trice	877	294.7	33.6	1	18.70	63.84	6	11½	25.5
Foster Str. 4	574	190.6	33.2	1 5/32	19.95	43.77	8	19½	24.5
Big Boll Rowden 40	940.5	325.4	34.6	31/32	18.30	68.78	4	8¾	2
D. & P. L. 4-8	856	340.7	39.8	1	18.70	71.44	2	7½	17.5
Wilds No. 2	692	228.3	33.0	1 7/32	21.75	56.62	7	15½	32

fertilizer applied to have obtained the best result. Fertilizer was applied on April 23 and planted on April 29. Tables 17, 18, 19 give the results of this work in detail. The varieties in Tables No. 17 and 18 were replicated 14 times and in Table No. 19 the varieties were repeated only ten times.

TABLE No. 19

10 Varieties of Cotton—Anderson Field—1929

Variety	Pounds per Acre		Lint Data				
	Seed Cotton	Lint	% Lint	Lgth	@ per Lb.	$ per A. Total	Rank in Value
Stoneville No. 1	542	194.6	35.9	1 1/32	19.15	42.48	9
Stoneville No. 3	788	301.8	38.3	1 1/16	19.30	65.54	1
Maretts Clev. B. B. Strain 7	549	183.4	33.4	31/32	18.30	39.04	10
Maretts Clev. B. B. Strain New 5	728	265.7	36.5	29/32	17.60	53.69	5
Stoneville No. 2	768	275.2	35.7	1 1/32	19.15	60.09	2
Delfos No. 2	612	205	33.5	1 1/16	19.30	45.66	7
Delfos 6102	618	203.3	32.9	1 3/32	19.35	45.56	8
Half & Half	698	284	40.7	27/32	16.50	53.07	6
D. & P. L. 4-8	692	272	39.3	1 1/32	19.15	58.39	3
Acala Strain 37	695	253	36.4	1 1/32	19.15	55.08	4

WILT RESISTANT VARIETIES

There were 16 varieties included in our test this year, each having been repeated five times. In this test the varieties were planted in single rows. These varieties were planted April 24 and the soil was inoculated with wilt culture prior to planting. The basis of fertilizer used uniformly on this test was 700 lbs. per acre of a 4-8-4 fertilizer. Table No. 20 gives the result of this work in detail.

TABLE No. 20
Wilt Resistant Varieties—Boyd Smith Field—1929

Variety	Pounds per Acre		Lint Data					
	Seed Cotton	Lint	% Age	Lgth	Cents per Lb.	$ per A.	Rank in Value	% Wilt
Clev. Pied.	1280	464.6	36.3	27/32	16.50	88.89	7	6.4
Half & Half No. 1	880	352.9	40.1	27/32	16.50	66.14	15	4.4
Half & Half No. 2	1030	432.6	42.0	27/32	16.50	80.34	10	3.2
Cook 307-6	1070	409 8	38.3	13/16	16.50	77.52	11	4.8
Rhyne's Cook	995	380	38.2	29/32	17.60	76.11	12	2.2
D. & P. L. 4-8	1160	455.9	39.3	1 1/32	19.15	97.86	2	6.6
D. & P. L. 6	1080	408.2	37.8	1 3/32	19.35	89.07	6	5.8
5242A-310-46	1080	468.7	43.4	31/32	18.30	94.95	3	5.4
D. & P. L. 10	1300	494	38.0	1	18.70	104.47	1	8.2
Delfos 6102	1235	419 9	34.0	1 1/16	19.30	93.27	4	9.6
Missdel No. 1	990	328.7	33.2	1 5/32	19.95	75.50	14	3.8
Misdell No. 2	985	340.8	34.6	1 1/8	19.70	76.80	13	7.2
Dixie Triumph	1145	425.8	37.2	31/32	18.30	88.71	8	4.4
Light. Ex. 7	1075	360.1	33.5	1 1/8	19.70	81.66	9	6.6
Willis Triumph	1255	450.5	35.9	7/8	17.35	90.23	5	6.4
Super Seven 4	830	269.8	32.5	1 3/32	19.35	60.61	16	2.6

REGULAR FERTILIZER WORK

For the years 1925-26-27, this fertilizer test was conducted under corn and for the years 1928-29 this same fertilizer test was conducted under cotton. In these five years each plat received the same kind and same amount of fertilizer heretofore used. Fertilizer was applied April 19, and planted to D. & P. L. 5242A-310-46 cotton seed on April 25.

Table No. 21 gives the result of this work in detail, each result reported being the average of triplicate tests.

TABLE No. 21

Analysis Test with Cotton—Moody Field—1929

Lbs. Material Applied per Acre				Lbs. Seed Cotton per Acre			Dollars per Acre		
Nit. Soda	Super. Phos.	Muriate Potash	Analysis	Plot Yield	Check Yield	Increase	Value of Increase	Cost of Fert.	Net Gain
No fertilizer				795					
160	300	100	4-8-8	1450	777	673	40.38	8.96	31.42
160	300	75	4-8-6	1645	760	885	53.10	9.38	43.72
160	300	50	4-8-4	1385	742	643	38.58	7.81	30.77
No fertilizer				725					
160	300	25	4-8-2	1490	713	777	46.62	7.23	39.39
160	300	0	4-8-0	1255	702	553	33.18	6.66	26.52
320	300	50	8-8-4	1265	691	574	34.44	11.81	22.63
No fertilizer				680					
240	300	50	6-8-4	1430	670	760	45.60	9.81	35.79
160	225	50	4-6-4	1265	660	605	36.30	7.15	29.15
160	150	50	4-4-4	1145	650	495	29.70	6.48	23.22
No fertilizer				640					
320	600	100	4-8-4	1850	804	1046	62.76	15.62	47.14
480	900	150	4-8-4	2110	968	1142	68.52	23.44	45.08
640	1200	200	4-8-4	1980	1132	848	50.88	31.25	19.63
No fertilizer				1295					

COOPERATIVE FERTILIZER TEST WITH COTTON

This station continued the cooperative fertilizer test this year as heretofore. This test was conducted in only two South Mississippi counties due to the fact that we could not find land suitable for this test, where there was a county agent to cooperate with. For another year, we hope to get more of this work started in counties where such work has never been carried on. The two counties in which this test was conducted was in Pike, and Forrest, in cooperation with County Agent A. J. Flowers and G. H. Alford in Pike county, and with County Agent W. M. Sellers and T. E. McCardle in Forrest county. The fertilizer test as conducted on Mr. Alford's place was in three replications. Due to the adverse weather conditions in July and August, and the high infestation of boll weevil the latter part of the growing season, we do not give the summary table showing the results in Pike county.

Since 1925, this fertilizer test has been conducted in Forrest county on the place of T. E. McCardle, and in cooperation with County Agent W. M. Sellers. For four successive years this work was conducted in four replications. In this year's test we

only used three replications. This fertilizer was distributed on March 28, and Half & Half cotton seed planted about the tenth of April. Mr. McCardle did not poison against weevils and the result was a high infestation of weevils throughout the growing season. Table 22 gives the result of this work in detail.

TABLE No. 22

Fertilizer Analysis Test—T. E. McCardle—Forrest County—1929

Lbs. Material Applied per Acre				Pounds Seed Cotton per Acre			Dollars per Acre		
Nit. Soda	Super. Phos.	Muriate Potash	Analysis	Plot Yield	Check Yield	Increase	Value of Increase	Cost of Fert.	Net Gain
No fertilizer				430					
160	300	100	4-8-8	663	414	249	14.94	8.96	5.98
160	300	75	4-8-6	827	399	428	25.68	8.38	17.30
160	300	50	4-8-4	830	384	446	26.76	7.81	18.95
No fertilizer				369					
160	300	25	4-8-2	921	358	563	33.78	7.23	26.55
160	300	0	4-8-0	941	349	592	35.52	6.66	28.86
320	300	50	8-8-4	1002	336	666	39.96	11.81	28.15
No fertilizer				325					
240	300	50	6-8-4	902	344	558	33.48	9.81	23.67
160	225	50	4-6-4	832	363	469	28.14	7.15	20.99
160	150	50	4-4-4	844	382	462	27.72	6.48	21.24
No fertilizer				402					
No fertilizer				430					
320	600	100	4-8-4	968	417	551	33.06	15.62	17.44
480	900	150	4-8-4	878	405	473	23.38	23.44	4.94
640	1200	200	4-8-4	824	392	432	25.92	31.25	—5.33
No fertilizer				380					

TABLE No. 23

Factory vs. Home Mixed Fertilizer Under Corn

Lbs. Material Applied per Acre			Bushels Husked Corn per Acre		
Factory Mixed	Home Mixed	Analysis	Plot Yield	Check Yield	Increase
Check			11.5		
600		4-8-4	23.5	12.5	11.0
	600	4-8-4	22.5	13.5	9.0
Check			14.5		

FACTORY vs. HOME MIXED FERTILIZER UNDER CORN

In this test we compared only one factory mixed fertilizer against one home mixed fertilizer. We used twenty-five 1/20 acre plats in this test which made nine replications for each fertilizer used. In mixing the home mixed fertilizer, nitrate of soda, superphosphate, and muriate of potash was

used in the proper proportions to furnish the same amount of plant food as would be supplied by the factory mixed fertilizer. This fertilizer was applied at the rate of 600 pounds per acre of a 4-8-4 fertilizer. Corn was planted on April 25, the variety being Calhoun Red Cob. Table No. 23 gives the results in detail.

FERTILIZER ANALYSIS TEST—CORN

For five successive years this fertilizer work has been conducted on the same land. For the year 1925-26-27 this test was conducted on sweet potatoes, and for the years 1928-29, this test has been conducted on corn. For the five-year test each plat has received the same kind and amount of fertilizer. The fertilizer was applied on April 10, and planted on April 20. The result shows that a highly nitrogenous fertilizer used in rather low amounts gives most economical returns. Table No. 24 gives the result of this work in detail, each result being the average of triplicate test.

TABLE No. 24

Fertilizer Analysis Test—Corn—Moody Field—1929

Lbs. Material Applied per Acre				Yield per A. in Bushels			Dollars per Acre		
Nit. Soda	Super. Phos.	Muriate Potash	Analysis	Plot Yield	Check Yield	Increase	Value at $1 Bu.	Cost of Fert.	Net Gain
No fertilizer				23					
160	300	100	4-8-4	37	23	14	14	8.96	5.04
160	300	75	4-8-6	35.5	22.5	13	13	8.38	4.62
160	300	50	4-8-4	36	22	14	14	7.81	6.19
No fertilizer				21.5					
160	300	25	4-8-2	34	21	13	13	7.23	5.77
160	300	0	4-8-0	34	20.5	13.5	13.5	6.66	6.84
320	300	50	8-8-4	41	20	21	21	11.81	9.19
No fertilizer				20					
240	300	50	6-8-4	39	22	17	17	9.81	7.19
160	225	50	4-6-4	36	24	12	12	7.15	4.85
160	150	50	4-4-4	39	26	13	13	6.48	6.52
No fertilizer				27.5					
320	600	100	4-8-4	44.5	28	16.5	16.5	15.62	.88
480	900	150	4-8-4	45	28.5	17.5	17.5	23.44	—5.94
640	1200	200	4-8-4	42	29	13	13	31.25	—18.25
No fertilizer				30					

TABLE No. 25

Nitrogen Sources Test—Corn—1929

Pounds Material Applied per Acre	Sources of Nitrogen	Analysis	Yield in Bu. per Acre	Check Yield	Increase	Value of Increase $1 Bu.
600		0-8-4	20.5			
320	Nitrate Soda	8-8-4	46 5	20.5	26	26
240	Am. Sulphate	8-8-4	40.5	21	19.5	19.5
220	Cal. Cyanamid	8-8-4	43.5	21	22.5	22.5
600		0-8-4	21.5			
300	Cal. Nitrate	8-8-4	47	21.5	25.5	25.5
105	Urea	8-8-4	43.5	21	22.5	22.5
185.6	Leunasalpeter	8-8-4	45.5	20.5	25	25
600		0-8-4	20			

NITROGEN SOURCES TEST

For five successive years this fertilizer test has been conducted on the same land. In the year of 1925-26-27 this test was conducted under cotton and for the years of 1928-29, it was conducted under corn. There are twenty-five 1/20 acre plats, which gives three replications of each source of nitrogen used. This fertilizer was applied at the rate of 600 pounds per acre of a 0-8-4 fertilizer and the nitrogen plats receiving 48 pounds of actual nitrogen per acre. This fertilizer was applied on April 10 and planted on April 22. Table 25 gives the result of this work in detail.

VARIETY OF CORN

In this test we used 18 varieties of which 17 varieties were sent from the A. & M. College and the other varieties were obtained from the Louisiana Experiment Station. Each variety was planted in single rows, three of these being repeated 16 times, 13 varieties being repeated 15 times, and two varieties having been repeated only 14 times each. The fertilizer was applied in drills on March 10 at the rate of 400 pounds per acre of a 4-8-4 fertilizer with an additional 75 pounds per acre of nitrate of soda as side dressing, which was applied on June 12. These varieties were planted April 26. At the time of harvesting, this corn was husked and weighed, and an equal amount of each variety was put aside for later determination of the percentage of grain, and the separation into first, second, and third grade as a measure of the soundness of the corn. In getting the yield per acre 70 pounds was taken for a bushel. Table No. 26 gives the result of this work in detail.

TABLE No. 26
Corn Variety Test—1929

Variety	Bu. per A.	% Grain to Cob	% First Grade	% Second Grade	% Third Grade
Mosby Station	41	86	81	15.2	0
Mosby Delta	36.5	82	79.3	15.2	0
Mosby D. & P. L.	27.5	88	65.7	25.7	7.1
Mosby Suttle	31	81.2	81.9	13.4	0
Mosby Cork	29.5	81 2	93.3	4.3	0
Cocke's Prolific Sta.	34.5	85	79.6	18.4	3.7
Cocke's Prolific Del.	35	86	71.4	26.9	0
Hastings	35.5	81	86.6	10	0
College 47	37	86	79.6	16.6	0
Laguna	37	86	88	8.9	0
Mexican June	35	85	82	14.9	0
Paymaster Neal	35 5	76.6	54.4	35.3	4.4
Paymaster Fisher	40.5	87	63.7	22.5	7
Yellow Dent Ferg.	27.5	79	59.6	32.3	0
College Y-4	35.5	82	88	9.7	1.5
Golden Dent R. H.	32	84	78	29.4	0
College G-4	37	82	94.5	2.7	0
Creole	34	82	85.3	13.2	0

WORK WITH OATS

For four successive years oats have been planted on 128 plats, 1/20 acre each, for the purpose of testing out different fertilizers, and also different dates for applying these fertilizers. On the nitrogen sources test, we used 600 lbs. per acre of a 0-6-4 fertilizer as a basic mixture, applying 36 lbs. of actual nitrogen per acre to the plats receiving nitrogen. From the six different sources of nitrogen used, calcium nitrate, and nitrate of soda, gave the largest increase. The rate of application of fertilizer on oats was varied at the rate of 200, 400 and 600 lbs. per acre, using

TABLE No. 27
Nitrogen Sources of Oats—600 Lbs. per Acre

Sources of Nitrogen	Bushels per Acre	Check Yield	Increase
0-6-4	27.8		
Nitrate Soda	50.1	27.4	22.7
Cal. Nitrate	52.6	27.0	25.6
Cal. Urea	48	26.6	21.4
Leunasalpeter	50.3	26.2	24.1
Urea	46.0	25.8	20.2
Cal. Nitro.	46.1	25.4	20.7
0-6-4	25.0		

TABLE No. 28

Rate Application on Oats

	Amt. Fert. Used	Bushels per Acre	Check Yield	Increase
Check		21.5		
6-0-0	200	31.4	21.6	9.8
6-0-0	400	43	21.7	21.3
6-0-0	600	45.1	21.8	23.3
Check		21.9		
6-6-0	200	32.6	21.8	10.8
6-6-0	400	40.4	21.6	18 8
6-6-0	600	45.0	21.4	23.6
Check		21.3		

TABLE No. 29

Fertilizer Applied March 1, 1929; Planted October 19, 1928

Rate 600 Pounds per Acre

Analysis	Bushels per Acre	Check Yield	Increase
6-0-0	30.4		
6-6-0	36.6	31.7	4.9
6-6-2	38.2	33.0	5 2
6-6-4	37.3	34.3	3.0
6-0-0	35.5		
6-6-6	37	34.6	2.4
6-8-4	35.8	33.7	2.1
6-4-4	35.8	32.8	3.0
6-0-0	31.9		

TABLE No. 30

Time Application on Oats—600 Pounds per Acre

Check	Time of Fertilizer	Bushels per A.	Check Yield	Increase
Check		16.5		
6-0-0	February 12	33.3	16.4	16.9
6-0-0	February 25	35	16.2	18.8
6-0-0	March 11	34.8	16.0	18.8
Check		15.8		
6-6-0	February 12	41.7	16.2	25.5
6-6-0	February 25	41.6	16.7	24.9
6-6-0	March 11	38.3	17.2	21.1
Check		17.6		

nitrate of soda alone, and where superphosphate was added, six per cent of each was used, the rate varying from 200, 400 and 600 lbs. per acre. On the time application on oats, the first date of applying the fertilizer was February 12, the second, Feb. 25, and the third, March 11. The largest increase obtained in this test was when a 6-6-0 fertilizer was applied on February 12, at the rate

of 600 lbs. per acre. The increase obtained on the analysis test on oats does not show very much difference. The oats were threshed and the weights averaged in bushels per acre. Tables 27, 28, 29, and 30, give the results in detail, the results reported being the averages of four replication.

1929 — REPORT OF HORTICULTURAL WORK AT SOUTH MISSISSIPPI EXPERIMENT STATION

By
W. S. ANDERSON, Horticulturist

The experiments with horticultural crops at this station for 1929 can be grouped under the following headings: (1) Plant Selection Work; (2) Fertilizer Experiments; (3) Variety Experiments; (4) Nematode Control Experiments.

PLANT SELECTION WORK

CUCUMBERS: Selection work in an effort to improve the type of cucumber grown for pickling purposes, which was started in 1927, has been conducted in 1929. This work, it will be remembered, was started in cooperation with the American Pickle Company of Wiggins, Mississippi, and is continued in cooperation with that company's successors, the Widlar Pickle Company. Selections are being made each year among plants grown from the seed produced by one fruit from a single vine. The seed vine is chosen on its ability to produce early the most acceptable type cucumbers.

SWEET POTATOES: Work was started here this year which it was hoped will improve the Porto Rico variety of sweet potato. It is probably well known that in this section there is much complaint of a noticeable variableness in the type and color of Porto Rico sweet potato now being grown. On account of this, our seed stock was gone through last spring and a sample taken, every root of which was uniform in color, both of skin and flesh. It was necessary to cut each sweet potato and examine it very carefully for color variations. These selected sweet potatoes were bedded and planted in a variety test along with 12 other varieties and is being called for convenience "Selected Porto Rico." It is expected that this work will either result in an improvement in our Porto Rico variety or the finding out that such improvement is impossible by selection.

BLUEBERRIES: Mention has been made in previous reports of the work here of selection among wild plants of the Florida blueberry. Three selections have been made and representative plants isolated and propagated from this year. The remainder of the planting is being handled so as to cause maximum production and is being watched for any interesting developments.

Mention was also made in connection with blueberry experiments last year of tests started to determine the carrying qualities of these berries when shipped by express without ice. This work is being continued and it is being found that when these berries are shipped in ventilated cardboard cartons containing 12 ventilated pint baskets that they carry exceedingly well to points as far distant as Savannah, Georgia. They will be shipped to more distant places next year, and reports made of the success.

FERTILIZER TESTS

TOMATOES: A new test of fertilizers under tomatoes was planned for 1929 and the fertilizers actually distributed, but when the plants were transferred from the hotbed to a cold frame, they were attackd by nematodes to such an extent that our stand was ruined. We plowed up the land, and therefore have nothing to report on tomato fertilizers for this year.

SWEET POTATOES: The land used for testing out fertilizer formulas under sweet potatoes during the years 1925 to 1928, inclusive, was used during 1929 for studying sweet potato fertilizers from a little different angle. These studies include tests of carry-over effects on 8 plats in two series; the effects from adjacent row treatments on 12 plats in three series; the effects of applications of high amounts of nitrogen upon yield and quality on 6 plats in three series. Very little can be said or written about these tests for this year. The results which should be self-explanation, are tabulated in three tables, Nos. 31, 32, and 33, accompanying this report.

SNAPBEANS: A test was started here in 1929 of fertilizers under early snapbeans. Eleven plats in four series were employed and the Burpee Stringless variety used. Plats 1, 6 and 11 in each series were used as a check for comparisons and were treated with 1,500 pounds per acre of a factory mixed 4-8-4 fertilizer. All plats received a side dressing of 240 pounds per acre of nitrate of soda one month after planting. There were three rows in each plat and the records were taken from the center row. The results of this experiment are reported in Table No. 34.

The most that can be said for this test is that on account of a drouth, the yields were cut at least 25%.

IRISH POTATOES: An experiment was started here this year testing fertilizers under Irish potatoes and 11 plats in five series were used with the treatments and arrangement of plats being identical with that in the case of snapbeans, except that the nitrate of soda side dressing was applied to the potatoes six weeks, instead of four, after planting. The entire crop was harvested on May 21 and the results are tabulated in Table No. 35, accompanying this report.

STRAWBERRIES: Explanation was made in the 1928 report of an experiment started here the year before with fertilizers under strawberries, the work being done on 17 plats in four series on land located in what we call the "Kindred Smith Field." The application of fertilizer was divided so that half of it was put on the first of July, 1928, and the other half the first of December, 1928. There was also a side dressing of 275 pounds per acre of nitrate of soda applied on March 11, 1929. The results obtained from this year's crop are tabulated in Table No. 36, and should need no explanation.

PEACHES: An explanation was made in the previous two years' reports of a test started here in 1927 comparing a dozen fertilizers under peaches. No crop was set on these trees in 1929 and therefore no results are yet ready for publication. Except for one corner of the orchard where nematodes have infested the tree roots and caused many of them to die, the trees in this experiment are growing excellently well and without any weather hazards, should set a nice crop of fruit in 1930.

PECANS: We are sorry to report that again in 1929, there was no crop of nuts on Stuart pecan trees in this section and we therefore have nothing to report from the tests of fertilizers under pecans, which has been continued since 1925, in cooperation with Governor Bilbo, on his orchard near here.

VARIETY EXPERIMENTS

VEGETABLES: The vegetable variety experiments this year included a test of 73 strains of Triumph Irish potatoes, obtained from as many different sources and being both certified northern grown, and uncertified northern grown, as well as uncertified Mississippi grown. These experiments also included a test of 13 varieties of sweet potatoes and four varieties of watermelons. A detailed report of the test of strains of potatoes has been issued

in Mississippi Experiment Station Circular No. 85, which can be obtained for the asking. The results obtained from the sweet potato variety tests are reported in Table No. 37, which accompanies this report and which can easily be understood. Suffice it here to say that no one should attempt to be guided by one year's results when planning to plant new or unusual varieties.

The results of the tests of four varieties of watermelons has not been tabulated on account of the production being so unsatisfactory. The varieties planted included Tom Watson, Wonder, Stone Mountain, and Thurmond Gray. Only Wonder and Stone Mountain made crops of melons of a marketable size. It is expected that these two varieties and several others will be included in a more thorough test of watermelon varieties next year.

FLOWERS: An experiment was started here this year testing 34 varieties of bush roses. Small plants of the above number of varieties were obtained and set on March 16 in well-prepared soil. It is planned to record for all of these varieties the resistance to disease, the earliness of blooming and the number of blooms, as well as the life of the bloom after being cut.

FRUIT: Observations among 62 varieties of peaches have been continued here in 1929 the same as in the past and Table No. 39 shows in detail the results obtained from the varieties fruiting this year.

Much attention is still being given apples in an effort to find which are adapted to this section and which will not blight. Thirty varieties are now growing in the orchard of which not more than three ever bear respectable crops and only one of these is apparently worthy of recommendation. The three, named in the order of their adapabilty are Hackworth, Day, and Red Astrachan. Scions are being obtained from many sources of South Mississippi where an apple tree is found fruiting and not blighting, in a further effort to locate adaptable varieties.

Studies are being continued with varieties of bunch grapes and muscadines, there being in the orchards this year 28 varieties of the two. In addition to the variety vineyard which was planted in 1920, there was put out at the beginning of this year, approximately one acre to Thomas and Scuppernong muscadines, which will serve as an additional test of the varieties as well as a demonstration to prospective growers of the section. Grapes are no doubt a valuable fruit crop for South Mississippi and this station is losing no time in finding the best varieties to grow. Work is being planned whereby tests are to be made of many different

high quality table grapes grafted on various thrifty stocks. These efforts, it is expected will result in the finding of some combination of scion and stock which will mean that we are able to grow here table grapes of a high market quality.

Studies have been continued during 1929 of the several pecan varieties set in the orchard in 1920, and Table No. 38 shows the details of data tabulated on these varieties this year.

Records are being continued of the behavior of various citrus fruits planted in the variety orchard and we report that 38 satsuma trees made an average of 127 fruits per tree this year with one tree making a total of 398 fruits. One Calamondin orange tree two years old bore 52 fruits. A Meyer lemon tree, which was killed back to the mounds in 1928 by a freeze when the temperature went as low as 16° F., made 20 fruits of large size and good quality. One Duncan grapefruit tree ripened 15 fruits. One of the four Thomasville citrangequat trees three years old ripened one fruit, this being the first fruit the variety had set since being planted. It might be explained that this is a hybrid fruit of which the Florida people claim much as an ade fruit. All varieties of Kumquats continue to bear heavy crops each year. It is regretted that a freeze occuring on December 20 this year, when the temperature went as low as 16° F., has apparently done considerable damage to all citrus fruits. It is impossible at this time to tell the exact extent of the damage, but it is certain that all foliage, even on satsuma trees, will drop off, while there is little doubt but that much damage will be done to the wood of the more tender varieties of citrus fruits, such as grapefruit, Calamondin and lemons.

Observations are being continued in the variety test orchard of the behavior of the seven varieties of blueberries, three varieties of briar berries, four varieties of Chinese Jujubes, two varieties of cherries, 12 varieties of pears, two varieties of nectarines, four varieties of persimmons and one each of pomegranate, Chinese Chinquapin and English Walnut.

NEMATODE CONTROL EXPERIMENTS

Observations are being continued of the effects of different cultural practices on the control of nematodes on peaches and figs. No results are ready to be reported about the control of this pest on either of the crops. It has been mentioned in previous reports that part of the block of fig varieties has been mulched with straw instead of receiving clean cultivation. It

has been observed that at least 50% more fruits have set and ripened on the mulched area of Celeste than on the area of clean cultivation. The mulched block mentioned, maintained its green foliage much later in the season than did the trees under cultivation. Whether this increased vigor and ability to produce figs when mulched is a result of the effects of mulching on nematodes is somewhat doubtful, and remains to be proven more definitely.

TABLE No. 31
Sweet Potato Fertilizer Record—1929
Carry-Over Effects

Treatment		Yield per Acre Pounds	
1928	1929	No. 1 and 2	No. 3
600 lbs. 4-8-4	None	4200	2790
600 lbs. 4-8-4	600 lbs. 4-8-4	6180	4320
1200 lbs. 4-8-4	None	4680	2340
1200 lbs. 4-8-4	1200 lbs. 4-8-4	6930	5040
1800 lbs. 4-8-4	None	4980	2700
1800 lbs. 4-8-4	1800 lbs. 4-8-4	6900	3810
2400 lbs. 4-8-4	None	4640	2700
2400 lbs. 4-8-4	2400 lbs. 4-8-4	5970	2700
Average Check		2650	3580

TABLE No. 32
Sweet Potato Fertilizer Record—1929
Effects of High Percent of Nitrogen

Treatment		Yield per Acre Pounds	
1928	1929	No. 1 and 2	No. 3
600 lbs. 8-8-4	600 lbs. 10-8-4	5270	3975
600 lbs. 6-8-4	600 lbs. 8-8-4	3250	2240
Average Check		2650	3580

TABLE No. 33
Sweet Potato Fertilizer Record—1929
Effect from Adjacent Row Treatments

Treatment		Yield per Acre in Pounds	
1928	1929	No. 1 and 2	No. 3
None	600 lbs. 4-8-4	4520	2750
None	None	3330	2330
600 lbs. 4-8-8	600 lbs. 4-8-8	6560	3200
600 lbs. 4-8-8	None	5510	3400
600 lbs. 4-8-6	600 lbs. 4-8-6	5120	2970
600 lbs. 4-8-6	None	4850	3070
None	600 lbs. 4-8-4	3975	2940
None	None	2020	2320
Average Check		2650	3580

TABLE No. 34
Snap Bean Fertilizer Record—1929

Lbs. Material Applied per Acre			Formula	Pounds per Acre		
Nit. Soda	Super. Phos.	Trona Potash		Plat Yield	Check Yield	Increase
1500 lbs. Factory Mixed			4-8-4	1664	1664	0
400	750	0	4-8-0	1325	1619	—267
400	750	200	4-8-8	2038	1573	465
400	750	300	4-8-12	1893	1527	366
600	750	100	6-8-4	1643	1481	162
1500 lbs. Factory Mixed			4-8-4	1435	1435	0
800	750	100	8-8-4	1560	1476	84
1000	750	100	10-8-4	1706	1517	189
1200	750	100	12-8-4	1893	1558	335
375 lbs. Factory Mixed			15-30-15	1248	1600	—352
1500 lbs. Factory Mixed			4-8-4	1643	1643	0

TABLE No. 35
Irish Potato Fertilizer Record—1929

Lbs. Material Applied per Acre			Formula	Pounds per Acre			
				Plat Yield		Check Yield	Increase
Nit. Soda	Super. Phos.	Trona Pot.		Number 1 and 2	No. 3	Number 1 and 2	Number 1 and 2
1500 lbs. Factory Mixed			4-8-4	6096	888	6096	0
400	750	0	4-8-0	4992	816	5864	—872
400	750	200	4-8-8	5204	768	5634	—430
400	750	300	4-8-12	5544	892	5404	140
600	750	100	6-8-4	4800	672	5174	—374
1500 lbs. Factory Mixed			4-8-4	4944	792	4944	0
800	750	100	8-8-4	4824	1056	5083	—259
1000	750	100	10-8-4	4992	720	5222	—230
1200	750	100	12-8-4	4344	696	5361	—1017
375 lbs. Factory Mixed			15-30-15	5688	792	5500	188
1500 lbs. Factory Mixed			4-8-4	5640	768	5640	0

TABLE No. 36
Strawberry Fertilizer Record—1929

Treatments			24-Pint Crates per Acre		
Plat No.	Formula	Amounts	Plat Yield	Check Yield	Increase
1	4-8-4	900 lbs. check	37.5	37.5	0
2	4-8-8	900 lbs.	46.0	38.8	7.2
3	4-8-6	900 lbs.	37.0	40.1	—3.1
4	4-8-2	900 lbs.	37.7	41.4	—3.7
5	4-8-4	900 lbs. check	42.9	42.9	0
6	4-8-0	900 lbs.	34.2	43.2	—9.0
7	None		42 9	43.5	— .6
8	8-8-4	900 lbs.	46.6	43.8	2.8
9	4-8-4	900 lbs. check	44.2	44.2	0
10	6-8-4	900 lbs.	44.6	48.0	—4.6
11	4-6-4	900 lbs.	41.7	51.8	—10.1
12	4-4-4	900 lbs.	38.8	55.6	—16.8
13	4-8-4	900 lbs. check	59.4	59.4	0
14	4-8-4	450 lbs.	44.9	55.0	—10.1
15	4-8-4	1200 lbs.	46 6	50.7	—4.1
16	4-8-4	2400 lbs.	44.5	46.4	—1.9
17	4-8-4	900 lbs. check	42.1	42.1	0

TABLE No. 37
Sweet Potato Variety Test—1929

Variety	Bushels per Acre		Percent	Rank on Basis of Yield of
	No. 1 and 2	No. 3	No. 1 and 2	No. 1 and 2
Nancy Hall	134.1	64.6	67	7
Red	292 0	69.5	81	1
Selected Porto Rico	255.0	81.9	75	3
194	266.6	139.5	65	2
Beattie Porto Rico	202.7	57.0	77	6
White Dooley	123.6	27.5	81	8
Big Stem Jersey	112.9	111.2	49	9
Creola	215.8	79.1	72	4
224	205.8	60.4	77	5
305	109.1	102.0	52	10
64377	104 0	27.0	79	11
Black Rock	68.7	40.8	62	12
57	56.2	33.3	62	13

TABLE No. 38
Pecan Variety Record—1929

Variety	Pounds per Tree Average	No. Nuts per Lb.	Per Cent Kernel
Moneymaker	2.5	65	44
Wright	1.5	62	38
Pabst	.5	92	30
Schley	1.5	78	49
Russell	1.5	85	57
Curtis	1.2	89	53
Success	1.7	66	39
Stuart	—	42	47
Teche	3.5	72	48

TABLE No. 39
Peach Variety Record—1929

Name	Age of Trees Years	Date Began Ripening	Average lbs. per Tree	Flesh Color	Stone Character
Early Mamie Ross	9	June 18	405	White	Cling
Slappy	9	June 17	109	Yellow	Free
Alton	9	June 18	183	White	Cling
Hiley	9	June 18	217	White	Free
Carmen	9	June 18	89	White	Cling
Early Rose	9	June 6	236	White	Cling
June Elberta	9	June 3	7	Yellow	Cling
Mayflower	9	May 18	Few Fruits	White	Cling
Belle of Georgia	9	June 28	180	White	Free
Elberta	9	July 12	133	Yellow	Free
Early Elberta	9	July 5	335	Yellow	Free
SPI 43137	7	July 5	62	Yellow	Cling
SPI 43127	7	July 5	Few Fruits	Yellow	Cling
Frank	4	July 17	26	Yellow	Cling
Lizzie	4	July 30	6	Yellow	Cling
Carmen	4	June 18	18	White	Cling
Belle of Georgia	4	June 28	13	White	Free
Captain Edes	4	July 17	26	Yellow	Free
Elberta	4	July 12	2	Yellow	Free
J. H. Hale	4	July 15	2	White	Free
Gold Medal	4	July 15	6	Yellow	Free
Chair's Choice	4		5	Yellow	Free
Hiley	4	June 18	13	White	Free
Yellow Hiley	4	June 18	13	Yellow	Free

Bulletin No. 275 December, 1929

Report From The Natchez Branch Experiment Station on Pecan Work To December, 1929

By
S. J. Greer
W. T. Mallory

A Valuable Tree

Native pecan tree topworked in May, 1914 to Stuart. It has produced nuts as follows:

In 1917	5 lbs.	In 1923	75 lbs.
In 1918	20 lbs.	In 1924	110 lbs.
In 1919	20 lbs.	In 1925	210 lbs.
In 1920	35 lbs.	In 1926	240 lbs.
In 1921	60 lbs.	In 1927	250 lbs.
In 1922	100 lbs.	In 1928	350 lbs.

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. College, Mississippi
J. R. Ricks, Director.

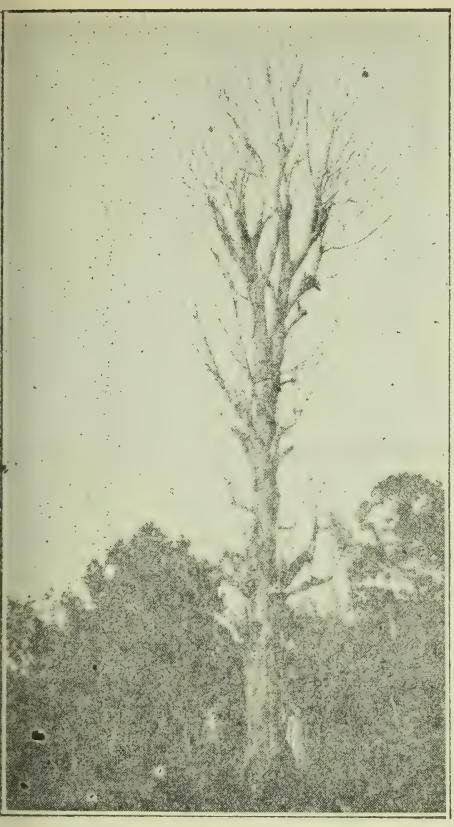
Report of The Work Done at The Natchez Branch Experiment Station on Pecans Prior to January 1, 1930

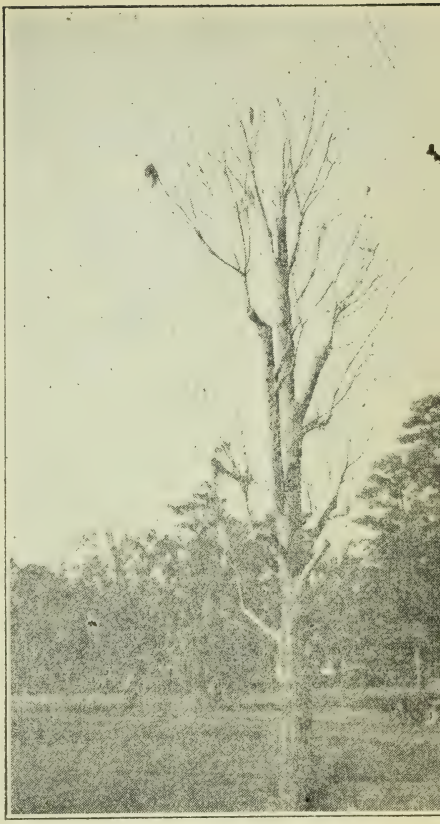
FOREWORD

This report presents the progress of the work at the Natchez Branch Experiment Station on the topworking of pecans. A brief historical sketch is given below in order that one may have a better appreciation of the facts which led to the arousing of interest in this work and to the soliciting of help in the establishment of a station for the investigation of the problems confronting the people of this section in the transforming of native seedling pecans to trees of standard varieties.

In various parts of Mississippi, Louisiana, Arkansas, Oklahoma and Texas millions of native pecan trees are to be found. In the section of country surrounding Natchez are thousands of such trees. These trees are worthless as producers of an acceptable commercial commodity, but they represent exceptional opportunity for use as stock on which may be topworked the various standard varieties of large, paper-shell pecan. Realizing the vast number of these trees already established and the possibility of converting them into valuable trees, farmers, business men, and progressive organizations have for many years shown an interest in methods by which these native seedling trees can be successfully changed to selected varieties.

As far back as 1914 a few pecan trees were topgrafted in this vicinity. These are now serving as an example of the possibilities in this work. In February, 1924, a few small bundles of Stuart pecan wood were cut and stored in an ice box at Natchez, Mississippi. This wood was kept dormant until May of the same year when it was used intopworking native pecan trees for a few interested farmers in Adams County. Some of these grafts lived and made a good growth . Being well located in the county, they were studied by farmers generally, and created a great deal of interest.





Figs. 2 and 3—Photograph of a pecan tree grafted in April, 1925. This picture was made in December, 1929. A large tree recovers slowly.

In 1925, grafting wood was again cut and stored for spring work. Several methods of grafting and budding were attempted dur ng the year, and a small number of trees were worked for nearly every farmer in Adams County. This was repeated in 1926. In February, 1927, an invitation was sent to Mr. J. R. Ricks, Director of the State Agricultural Experiment Stations, to come to Natchez and look over the work that was being done. This invitation was sent with the object of enlisting his aid in solving some of the important problems connected with topgrafting pecans. He studied very closely the work already started and found that some of it demonstrated wonderful possibilities. He also saw some work that was unsuccessful, and the failures were hard to understand. As a result of his visit, the Natchez Association of Commerce decided to raise $3,000.00 which was given to Mr. Ricks to be used in this region for studying and standardizing

pecan topworking methods. In April of 1927 Mr. W. T. Mallory was sent to Natchez to begin this work. He immediately selected eight farms in Adams County on which preliminary work was started. Five of these places are on public highways where they serve as demonstrations. One is at the city park, and two are on overflow lands near the Mississippi River.

In addition to working out methods of topworking, there was a demand for more definite knowledge on fertilizers, cultivation, varities, and disease control. These considerations led the State Legislature, at the regular session in 1928, to make provision for the establishment of a permanent branch experiment station to be located in this southwestern region of the state. Appropriations were made for the support of the station for 1928-1929. Provision was also made whereby any county in this region could donate land, or money for the purchasing of land for the station. In accordance with this provision, Adams County donated $25,000.00 for the purchase of land and buildings. This money was turned over to the trustees of the A. and M. College, and was used by them in purchasing three hundred and two acres of land at Foster, Mississippi, six miles from Natchez, on the Y. & M. V. Railroad. Plans were immediately made for fencing this land and for the construction of the necessary buildings. In the meantime a permit was secured from a special session of the State Legislature whereby the College authorities were permitted to spend part of the state appropriation for the purchase of more land containing the necessary buildings. The 1928 appropriation by the state was then used to purchase twenty-five additional acres of land on which were a dwelling, light plant, deep well, barns, poultry houses, garage and orchard.

Work was begun on the permanent station in October, 1928. The land was broken and planted to oats, rye, vetch, Austrian winter peas, and clovers. Nearly three miles of heavy wire fence and one-fourth mile of board fence with concrete corner posts were built. Terraces were constructed on part of the land, fence rows were cleared, and some of the rough lands were cleaned up, tenant houses were renovated, and cold frames were built.

PROBLEMS NEEDING SOLUTION

Ever since men began to give serious thought to fruit growing, budding and grafting have been practiced; but the topworking of pecans has brought new problems to this old art. When several hundred square miles suddenly appear as a potential pecan orchard where Nature has prepared the growing stock, the problem becomes much greater.

Observations on the behavior of grafts made in the earlier efforts at topworking pecans had, in the failures and successes which were experienced, presented many specific problems for solution, and suggested rather definite lines of investigation. At the very beginning

of the experiment the following points stood out as those needing special investigation:

1. Size of trees possible and practical to topwork.
2. Size of limb adapted to topworking, with respect to successful grafting and later heal ng.
3. Conditions necessary for union of grafts.
4. Time of year for cutting back native pecan trees.
5. Paints, waxes and preserving fluids for covering wounds.
6. Number and arrangement of native branches necessary to leave on trees of different sizes.
7. Length and treatment of stumps.
8. Advantage of insertion of scions at various points in the ultimate shape of the tree.
9. Time of grafting scions.
10. Age and size of scions.
11. Methods of storing and wrapping scions.
12. Temperature and humidity suited to storage of scions.
13. Time and method of setting each of the different types of grafts.
14. Means of preventing drying out of scions and unions.
15. Method of preventing injury from wind, insects and diseases.

INVESTIGATIONS CARRIED OUT

Pecan trees ranging from small to large have been cut back from November until May to force out new growth necessary for budding. Large and small limbs have been cut off in an effort to determine the best size of branch in which to insert grafts. The ends of stumps have been painted, unpainted, and covered with grafting wax and various preserving fluids. Varying proportions of the native branches have been removed in cutting back the trees, ranging from a removal of all to the retention of a large portion of them. The limbs have been cut back close to the trunk, and quite a distance out. Efforts to secure different shapes by inserting scions at different parts of the tree have been attempted.

Grafting wood has been cut and stored from November to March. One, two and three-year old wood has been stored and used in grafting. Scions have been wrapped in bundles with paper and kept moist, have been left unwrapped and stored in boxes of moist sawdust or moss. Temperature and humidity have been varied with the various lots.

Whip grafts and cleft grafts have been set from January to April. Bark grafts with both dormant and current year shoots have been attempted from April until August. Patch buds and ring buds have been used from June until September. Paraffin, coal tar, asphalt, and various grafting waxes and bandages have been used to seal unions and cover wounds. Tree surgery has been practiced in an effort to prevent decay and to promote healing. Records of the results of each of these methods have been made.

GENERAL INSTRUCTIONS PREPARATORY TO GRAFTAGE OPERATION

As a result of many years' observations and three years of experimental work, certain rather definite instructions may be offered in deciding upon some rather general points which necessarily come up before one is actually ready for the placing of the grafts. These have to do with:

1. The selection of proper varieties for the new tops.
2. The selection of properly spaced trees in the native groves and of such size as experiments have shown possible and practical to topwork.
3. The selection and preparation of branches of the proper size.
4. The use of the proper type of graft.
5. The relation of the type of graft used and season of the year grafting is done.

In the selection of varieties the list seems to narrow down to the Stuart, Success, Moneymaker and Schley. The Stuart is practically free of scab and a good fruiter, but the fruit is not of the best quality. The Success often scabs and is not a heavy fruiter, but the fruit is more desirable than the Stuart. The Moneymaker fruits regularly and heavily, but the nuts are of medium quality and irregular in size. The Schley produces a nut of the finest quality, but the tree is subject to scab and does not fruit regularly or heavily. There are other varieties that seem desirable, such as the Hale and Frotscher.

The trees which are to be used as stock should not be too large, nor should they stand too close together. To get satisfactory results, they should be at least fifty feet apart; and on heavy soils of high fertility, sixty to seventy feet apart. On land that overflows regularly grafts should be set above the water line; and where pastured, the grafts should be out of reach of the horses and cattle.

Branches from one to three inches in diameter offer the most desirable size for grafting. It is possible to make grafts on old stumps or very large limbs, but these are extremely slow in healing and are likely to produce worthless short-lived trees. It is seldom possible to secure a sound union and perfect healing when a limb is grafted more than four inches in diameter. Young and fast growing stock will heal over rapidly if not exceeding four inches in diameter, provided the cut surfaces are kept well protected by paint or grafting wax. If the tree is old or making slow growth, three inches should be the maximum diameter of limbs used for grafting.

By the use of different types of graft the season for grafting may be extended over a considerable portion of the year. The whip graft in the nursery may be used in January, February or March; the cleft graft may be used in February and March; the bark graft in April, May or June; and the ring or patch bud in July, August and September. Usually, trees from one to four inches in diameter are

selected for cleft grafting; trees from four to eight inches in diameter can generally be successfully worked by the bark graft. New sprouts from cut back tops offer the best point for inserting either the ring bud or patch bud. Occasionally trees greater than eight inches in diameter are bark grafted or cut back and buds placed on young shoots in July, August or September. Extremely old trees with rough limbs that are making a very slow growth are hard to topwork and are rarely profitable.

A wax consisting of four pounds of resin, one to two pounds of beeswax, and one pint of linseed oil, kept warm and applied with a brush, offers the best method of covering wounds and sealing unions.

WHIP GRAFTING

Whip grafts work best on stock not more than three-fourths inch in diameter. This method is most commonly used on two to four year old nursery stock in February, March, or early April. The scions should be cut from a tree of known variety, using a branch of the previous year's growth and as near as possible the same size as that of the stock to be grafted. Remove the dirt from the base of the nursery stock so that the graft can be set low. With a sharp knife remove the top of the seedling stock by a long sloping cut, as shown in Figure 4. Then split the stock about an inch deep, beginning nearest the upper edge of the cut surface as shown in Figure 4.

Fig. 4—Whip graft showing method of cutting stock and scion

When the stock is prepared, select a scion of as near the same size as possible, make a cut of the same length and shape as the stock, cut the scion off about two or three buds in length, wedge the stock and scion together as shown in diagram; the split tongues should slip one into the other so as to make a tight union, taking care that the cambium layer (the inner bark) is brought in contact on at least one side of the stock and scion. If the stock and scion are of the same size, there is no reason why the cambium layer should not come in contact on all sides of the graft. Where the scion is smaller than the stock, a contact of cambium layers can be had on only one side. When the stock and scion are wedged firmly together, they should be carefully waxed and wrapped with a cloth bandage. The wax should be put on with a brush; for this purpose it will be necessary to have a

slow fire to keep the wax melted. The bandage is made of strips of cloth about one inch wide. Care should be taken to seal all cut surfaces with wax, and then draw the bandage tight over the wax and tie it, or stick the ends in the wax. After the grafts are waxed and bandaged, most nurserymen prefer to cover them with loose dirt. This prevents evaporation, and the scions are more likely to grow. If the dirt becomes packed from heavy rains, it should be broken away or loosened as soon as the grafts begin to grow. Whip grafts can be set above the ground or in the top of trees, on small limbs, but are not as satisfactory there.

CLEFT GRAFTING

Cleft grafting is done in the late winter and early spring. The best season is February, March and early April. Earlier work can be done, but there is greater danger in the grafts drying out before the sap begins to flow in the spring. If grafts are to be set in early February, they should be entirely covered with a thin coat of melted paraffin or grafting wax to check evaporation.

In cutting the grafting wood for cleft grafting use wood of the previous year's growth and take it from trees of known varieties. Two year old wood can be used if the buds are normal. The wood should be kept wrapped in moist paper to prevent its drying. It can be kept for several days if wrapped well, buried in moist soil, or stored in an icebox; but it is best to take it from the tree each day as it is used.

Fig. 5—Showing method of cutting scion for cleft grafting.

Fig. 6—Showing cleft grafts set in the stock.

After the scions are cut, the limb of the tree to be grafted should be sawed off as shown in Figure 6. The best tool to make a cleft in

the stock is a broad chisel. A sharp hatchet or drawing knife can be used with good results. Set the chisel at a small angle with the grain of the wood so that it will cut rather than split the stock. If the chisel follows the grain of the wood, a very uneven edge is left on the bark, and it is impossible to get a good contact with the cambium. When the cleft is made in the stock, the scion should be driven in, as shown in Figure 6. The thick edge of the scion should be turned out and the cambium layer or inner bark brought in contact with the cambium layer of the stock. Where the limb to be grafted is two inches or more in diameter, two grafts can be set, one on each side. Sometimes it is necessary to drive a small wedge in the cleft to hold it open until the scions are placed. When the scions are placed, all openings and cut surfaces should be carefully sealed with grafting wax and then covered with a cloth bandage. For best results the wax should be melted and applied with a brush. Either waxed or unwaxed cloth bandage can be used. The wax should always be put on before the bandage.

BARK GRAFTING

Bark grafting is done in April, May and June, and best results have been gotten from work done in the early part of the season. It can be started as soon as the bark will slip in the spring. About April 10th is the average date for this region. This method should not be used after hot, dry weather begins, in June. Satisfactory work has been secured in July, but most of the work done that late has not given good results.

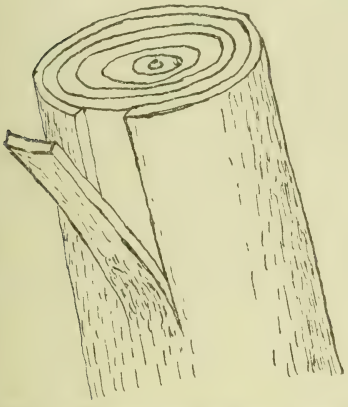


Fig. 7—Showing how the bark is split on the stock for bark grafting.

Scions for bark grafting should be cut the previous January or February and kept dormant. Cut medium sized twigs in bundles of fifteen or twenty, cover them with wet paper as soon as possible, and store them in an icebox where they will be kept moist. Wood for early April grafting may be stored in a cellar or buried in moist soil, but it will not keep in that condition after the warm weather of May.

If the tree to be grafted is four inches or more in diameter, it should be cut as shown in Figure 8. If the tree is less than four inches in diameter, it may be cut back to a stump, preferably about five or six feet high. When sawing the limbs, care should be taken to prevent them from splitting. Cut the under side of the limb first and then saw it off from above. Small trees, if grafted in April or early May, may have all the native branches cut away. If the work

is done later, one or more branches should be left to keep the tree alive until the grafts start. Large trees should always have a few branches left on them. See Figure 8. If too much top is left when a tree is cut back for grafting, the scions will not be forced out properly, and will either remain dormant or make a very poor growth. After the tree is properly cut back, begin setting the grafts. Take a stick of grafting wood from a bundle that has been kept dormant in an icebox, and cut the scion as shown in Figure 9.

Fig. 8—Showing a tree cut back for bark grafting

Fig. 9—Showing bark graft scion.

When the scion is properly cut, hold it against the bark on the stock where it is to be set and split the bark on each side with a knife, as shown in Figure 8. This insures a close fit. Push the scion down behind the bark, as shown in Figure 10.

The longer sloping cut on the scion should be turned toward the wood on the stock. When it fits tightly in place, it should be fastened with a nail, as shown in Figure 10. A number 18 regular wire nail, one inch long is best. The nail holds the stock and the scion tightly together and does not interfere with the growth. Care should be taken not to bruise the bark in driving the nail. The nail may be driven through the tongue of bark on the stock, or the bark may be cut back, as shown in Figure 10. After the scion is nailed in place, cover all cut surfaces with melted wax, and bandage it as in cleft grafting.

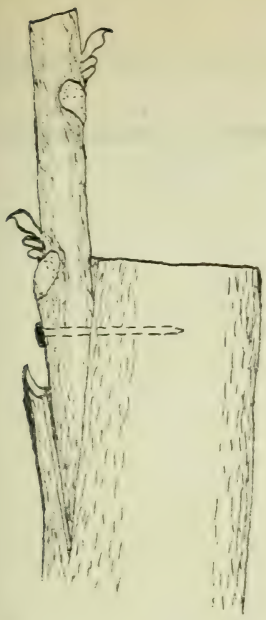


Fig. 10—Showing scion in place.

If the operator works fast, several grafts can be set before they are waxed and bandaged. Until he develops some skill, each scion should be waxed and bandaged as soon as it is set.

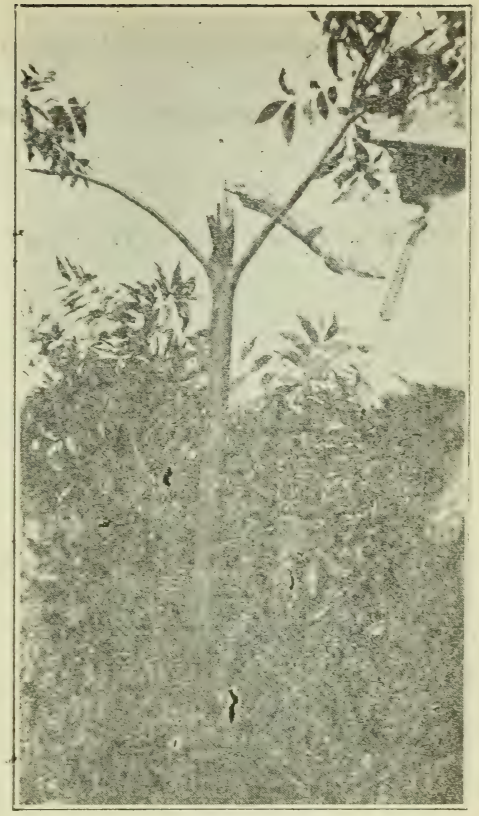


Fig. 11—

BUDDING

There are several different methods of budding in common practice. Some have distinct advantage over others, but with any method, much of the success depends upon the skill of the operator. Ring budding has been most satisfactory with us here. It seems to be best suited to the average person. Patch budding is just as simple, but has not given quite as good results.

While buds have been successfully set on stock one, two and even three years old, the best results have been obtained when buds of the present year's growth were set on stock of the same age. Buds, as a rule, become mature enough for use about the middle of July in this region. The budding season will last from then until about September 15th unless cut short by dry weather. Ring and patch budding are most successful when the bud wood and stock have a crisp, growing appearance and the buds come loose from the wood easily. If the

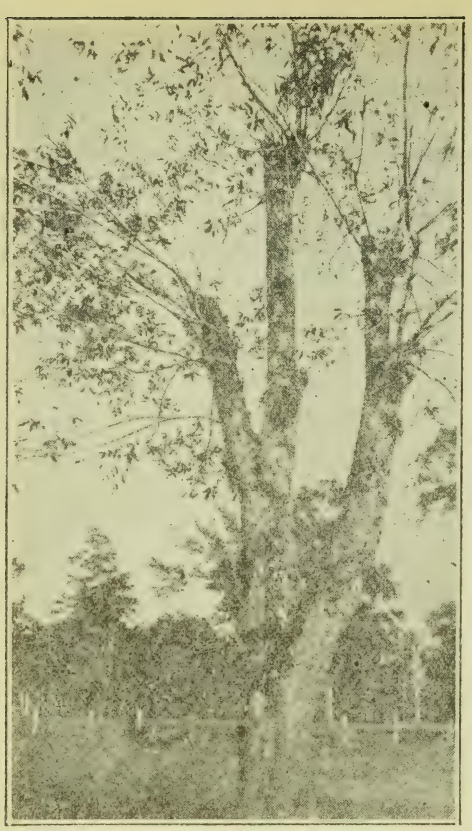


Fig. 12—Showing a tree improperly grafted. Limbs cut too large.

buds are removed from the stick with difficulty, or the stock is dry, they will not live. If the bark is thin and tender, and the twigs are not cylindrical, it is likely that the buds are too young and immature to grow. In budding, the necessary equipment is a budding knife and some waxed cloth or tape. The knife should have two parallel blades about one inch apart. If a regular budding knife cannot be bought from a hardware store, one can be made by fastening together the handles of two small fruit paring knives, or by taking a piece of wood one inch square and six inches long, and fastening two safety razor blades to the opposite sides of the stick near one end so that the blades extend about one-fourh inch below the wood, then by shaping up the handle and hollowing out the wood slightly between the blades.

If seedling pecan trees or nursery stock make a good growth, they can usually be budded in July and August of any summer from the time they are three years old until they are five or six. After they reach a height of ten or twelve feet, the wood of the proper age to bud is usually too high to begin a new top.

In order to successfully bud large trees, they should be cut back the previous winter or spring. Figure 14 shows a tree that was cut back in January and buds set on the new growth in July or August following. Sometimes grafts set in the early spring do not grow, and buds can be set on the new growth the same summer as if the tree had been cut back for budding. All cut surfaces should be carefully painted with a good grade of oil paint to prevent rot . It may be necessary to prune out some of the new growth in the spring in order to have large sprouts to bud in the summer. From two to five or

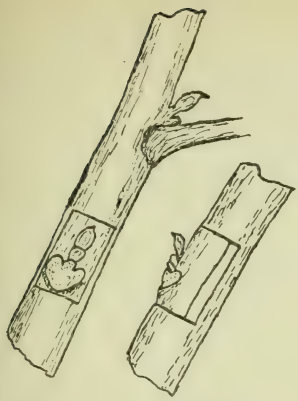


Fig. 13—Showing bud set on the stock.

more sprouts should be left on each limb to be budded. The operation of ring budding is very simple, but a little skill is necessary for satisfactory results.

Waxed cloth for bandage is necessary and can be prepared as follows: Take cheap domestic or sheeting and tear it in sheets about one foot square and dip it in a melted wax consisting of equal parts by volume of beeswax and resin with a small amount of linseed oil added. When the sheets are thoroughly saturated, take them out and draw them between the edges of two smooth boards t oremove the surplus wax. They can then be torn into strips about three-fourths inch wide, as they are used. Some prefer to tear the cloth into strips and wind it into balls before dipping into the wax. After the cloth is ready, cut the bud wood. Take the larger and older branches of the present year's growth from a tree of known variety. (Young trees produce better budding wood than old trees, because they make a more rapid growth.) As soon as the wood is cut from the tree, ermove the leaves to prevent evaporation. The leaves should be cut close to the wood without injuring the buds. In the early part of the budding season usually not more than one-half of the stick is old enough for use. It is always best to throw away the younger part of the bud stick. As soon as the leaves are removed, wrap the wood in wet paper or sacking. If possible, never cut it from the tree more than a day before it is to be used. When it is necessary to keep the wood for several days, store it in an icezox or other cool, moist place. Do not put it in contact with the ice.

Fig. 14—Showing a tree cut back and buds set on the new growth.

Nursery stock is usually budded from four to eight inches above the ground, but not higher than two feet, as it often

dies back when transplanted. If the trees are not to be transplanted, buds may be set higher. With larger trees, where the buds are intended to make branches rather than a main trunk, they can be set at any height. Nursery stock is generally given but one bud, while larger trees are often given as many as one hundred buds.

THE OPERATION OF BUDDING

Select a smooth place on the stock and cut the bark through to the wood with a double bladed knife (See Figure 13); rock the knife back and forth across the stick to cut the bark, but do not girdle the stock. A strip of bark not less than one-fourth inch wide should be left on one side of the stock to insure a steady flow of sap; next, select a bud on the scion and cut around it above and below with the same budding knife, then with vertical strokes on each side of the bud block it out. If the bud is in good condition, it is now readily lifted off with the thumb nail; next, remove the bark on the stock and place the bud as shown in Figure 13. The bud should fit snugly at the top and bottom, but should not quite fill up the space on the sides. A space the size of a match stem should be left on each side of the bud, as shown in Figure 13. This gives best results, probably because it allows better drainage of the sap. Buds cut with a patch budding knife fit on all sides and have not given as good results as those set by a ring bud method. When the bud is in place, hold it firmly and wrap with a piece of waxed cloth. Begin at the bottom and go up as you wrap, allowing the tape to overlap about one half of its width. The tape should cross above and below the growing point of the bud so that it is the only part exposed. The tape should be drawn just tight enough to hold the bud firmly in place. The stock should then be cut off about eighteen inches or twenty-four above the bud.

Twelve or fifteen days later the tape should be loosened or cut to prevent it from binding. It is generally best not to remove the tape until the following winter. Buds set early in the season will often make a growth of from one to two feet before the first winter. In case it begins a rapid growth the stock may be cut back to within six or eight inches of it. The stock should never be cut smooth with the bud during the first season's growth. Buds set late in the season should be left dormant until the following spring, when they are forced out by cutting the stock back to within six or eight inches of the bud. The tree should be pruned out during the winter following the budding. The tape should be removed, and the cut surfaces painted. If there are not enough buds living to make a well-balanced top, some branches should be left for budding the following summer.

AFTER CARE OF TOPWORKED TREES

Trees grafted early in the year often make a very rapid growth. If not pruned back, native wood will likely shade the grafts and cause them to die. This should have constant attention during the growing season. Grafts often grow so fast that a wind will break them off.

This can be prevented by keeping them pruned back from two and a half to three feet the first year. Braces are also helpful in preventing harm from the wind. Small lathes or poles can be tied or nailed to the tree and the grafts tied to them. The braces should be left until the grafts are firmly attached to the stock. A combination of pruning and bracing has given best results. We have had practically no trouble from grafts bursting out of small trees and nursery stock. The greatest amount of damage is done in larger trees. Topworked trees should be carefully pruned out each winter until all native wood is removed, the top is well balanced, and all cut places healed over.

All brush and limbs cut from a tree should be burned to prevent the breeding of bark beetles.

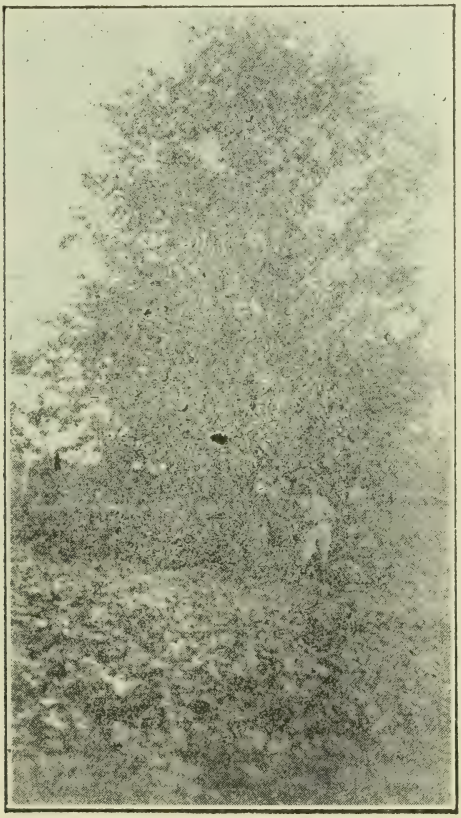


Fig. 15—Showing a tree that produced 20 lbs. of nuts three years after being grafted.

NURSERY PRACTICE

Pecans from various trees were stratified in December, 1928, and were planted in nursery rows in March, 1929. Most of the nuts germinated and there was quite a variation in the rate of growth. With the common pecan it appears that the rate of growth for the first year seedlings is in direct relation to the size of the nut. That is, the larger nuts consistently made a better growth than the smaller ones; however, it remains to be seen whether or not this relation will continue from year to year. Seed from bitter pecans or water pecans (Hicoria aquatica) was planted with the other pecan seed, and made a much better growth than the largest pecans. Many of the water pecans were large enough to bud in September, 1929, and practically all of them will be of sufficient size to whip graft in March, 1930. This variety makes good stock for grafting, and seems to thrive best in low lands.

Fig. 16—Showing Hicoria aquatica on the left; seedling from extremely large pecan in center; and seedling from small pecan on right. Average trees dug from the nursery October, 1929.

Bulletin No. 276 December, 1929

FARM PRACTICES IN SOUTH CENTRAL MISSISSIPPI WITH SUGGESTED CHANGES

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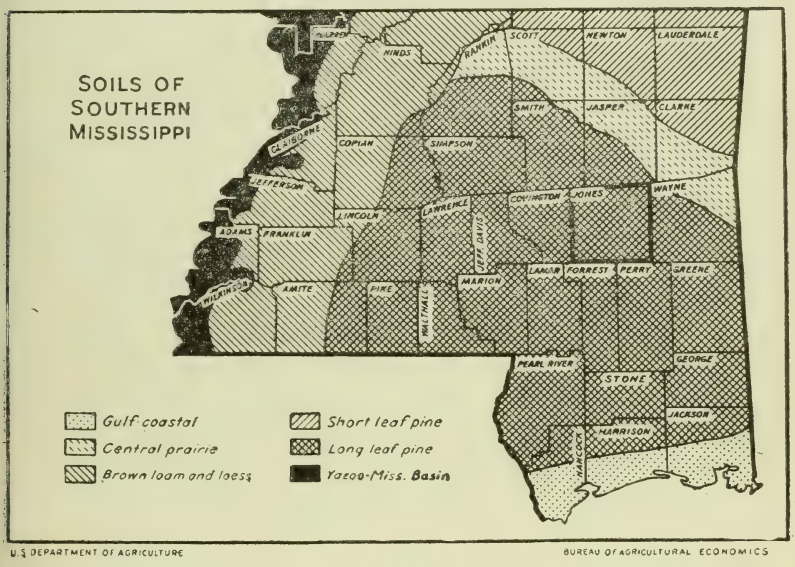

The conclusions in this Bulletin should apply throughout the long-leaf pine section shown by the heavily shaded portions of the map. Many of the suggestions will apply as well to the areas indicated by the lightly shaded portion.

United States Department of Agriculture
Bureau of Agricultural Economics
in Cooperation with
Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
J. R. RICKS, Director

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FARM PRACTICES IN SOUTH CENTRAL MISSISSIPPI WITH SUGGESTED CHANGES

Although southern Mississippi has been settled in some degree for more than one hundred years, much of the development in agriculture has been comparatively recent. The first settlers came to an area that was heavily forested, but which offered some grazing for cattle. Consequently the development of crop land in the area awaited the removal of the forest. Lumbering was for a long time the chief industry, but as the acres in timber land diminished, the way for farms was opened. The establishment of farms did not keep pace with the removal of timber and at the present time, large areas of cut over land are still undeveloped for agricultural purposes.

According to the United States Census for 1925, only 48.6 per cent of the land in Jones County, Mississippi, was in farms and of this only 37.6 per cent of the land actually in farms was classed as improved farm land. With only about 20 per cent of the total area improved and much of the remainder potentially tillable, the farms in this section of Mississippi have much room for expansion both in size and number.

Incomes from farming in the past have not been large enough to allow a standard of living that would encourage either the development of new farms or an extensive improvement of those already in operation. The opportunity for doing outside work in the lumber camps and saw mills has undoubtedly diverted the energy of the people from farming, but as the amount of timber decreases, more of the family earnings must come from the farm and this must come from a greater efficiency in the operation of the farms or the development of new farms from what is now the unproductive cut over land.

Purpose of Bulletin and Source of Data

This bulletin is based on detailed farm records obtained on farms in Jones County, Mississippi. It shows the systems of farming followed on 19 farms in the long leaf pine section for 1927 and on 15 farms in 1928, the crops produced, the yields obtained, and the fertilizer, labor and cost items that entered into production. It shows the number of livestock on the farms, the production obtained, and the feed, labor, and other cost items used on livestock. From this study of what was being done on farms in this section together with such other data from the Experiment Station as offer better methods and improvements of farm practices, suggestions for the improvement in the management of the farms are made. The bulletin should contain practical information for those who are beginning the development of farms in the area, to agricultural extension workers, and to farmers already established who are looking for means of increasing the earnings of their farms.

General Conclusions

Successful crop production in this area demands careful soil management and the judicious use of fertilizers. Terracing is essential in many of the fields and heavy applications of fertilizer are necessary if good crop yields are obtained.

Although improvements in the quality and production of the cattle kept on the farms must be delayed until the eradication of the tick,

opportunities for the raising of cattle and dairying will be increased when the area is tick free. With more cattle on farms the inclusion of pasture crops which will naturally follow in the cropping system should help to solve many of the fertility and erosion problems.

The nearby towns offer a limited market for truck crops and with these some of the farmers are profitably supplementing the chief crop, cotton. The local demand for truck crops is easily satisfied however and where shipping is undertaken, the hazards are greatly increased. Truck crops which may be fed to livestock in case of an inadequate market demand are ordinarily the most profitable.

On the farm, the field work is carried on with one or two-horse implements, and much of the work is done by hand labor. Even with the small fields made necessary by the uneven terraces there seems some possibility for increasing the size of farms which can be handled by one man through the use of two-horse implements. The emphasis which is placed on cotton results in a very uneven distribution of labor throughout the year. By adding to the farm business some enterprises to give profitable employment for a longer season of the year, the size of the business may be increased without creating a demand for more labor than is usually available on the farm.

Cotton has the first choice of crops in the farming system and is the most reliable source of income, and as a usual thing as much cotton as can be cared for is grown. The best opportunities for improvement in the organization of the farm business seem to lie in the production of corn for grain, hay, and cover crops for roughage or pasture and in the feeding of these crops to productive livestock.

Natural Conditions in the Area

Jones County is fairly typical of the counties lying in the long leaf pine section of Mississippi. Rainfall is heavy, the mean precipitation for the section being between 55 and 60 inches annually, and while it is generally distributed throughout the year, less rainfall is recorded for the months of September, October and November, the months of picking and harvesting late crops. The long summers adapt the section to cotton and allow double cropping for a number of crops. The short mild winters allow the growth of winter annuals and hardy pasture plants for practically the entire year.

The topography of the uplands which makes up two-thirds of the area of Jones County varies from flat or undulating to a ridgy or rough surface. 1| The western part of the county, the section in which the farm records were obtained, is rolling to rough land and here the land is more subject to erosion than is the more level land in the eastern part of the county. The rolling land is too steep for cultivation unless terraced and the soil carefully handled. Natural terrace or second bottom land and the stream bottoms make up slightly less than one-third of the area of the county, The value of this land for farming depends on its drainage and although much of this land making up about 15 per cent of the county area is tillable or easily drained for cultivation, much of the first bottom land is subject to overflow and could not be easily reclaimed for farming. As a rule, the first bottom is not considered farming land.

1/ Goodman, A. L. and Jones, E. W.—Soil Survey of Jones County, Mississippi, Bureau of Soils, U. S. Department of Agriculture Soil Survey, April, 1915.

The predominating soil type is fine sandy loam which, in its various soil series, makes up about 44.5 per cent of the county area. The other soils mapped are similar in texture, fertility and crop adaption. The upland soils in this section contain about 65 per cent of fine sand, 30 per cent of silt and about 5 per cent of clay. 2|.

Most of the soils are deficient in phosphates and nitrogen and in many cases crop production can be increased by the application of potash. Practically all of these require liming for the growth of lime-loving legumes. With proper soil management, good crop yields can be obtained, but because of the heavy rainfall and the nature of the soil, plant food leaches away rapidly and land left idle or uncared for soon loses its fertility.

Table 1—The Number and Average Size of Farms, Color, and Tenure of Operators, Jones County Mississippi, 1900 to 1925—Data From United States Census Reports

Year	Total Farms 1/	White farmers	Colored farmers	Full owners	Others	Average size of Farm
	Number	Number	Number	Number	Number	Acres
1900	1561	1366	195	1201	360	149
1910	2688	2232	456	1721	967	84
1920	2666	2283	383	1825	841	86
1925	2740	2335	405	1627	1113	79

1/ Includes croppers, renters, part owners and a few managers.

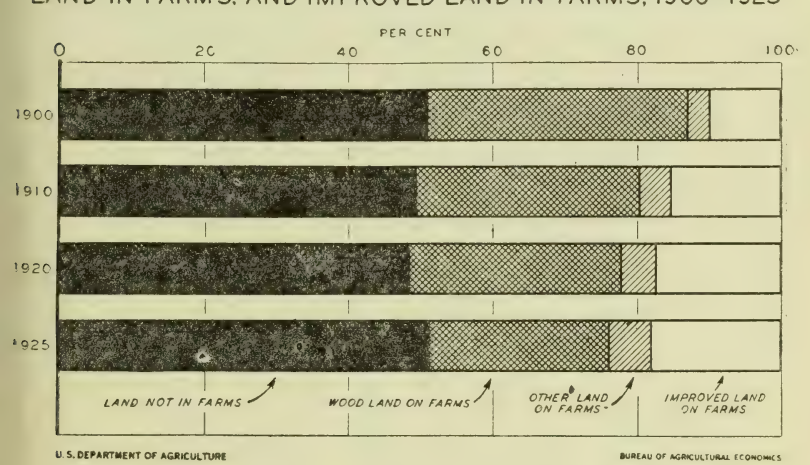

Figure I. Although improved land in farms has been increasing, the greater part of the land in farms is unimproved. With approximately half the land area not in farms, there is much room in the county for farmers and livestock men when economic conditions justify an expansion of agricultural industry.

RECENT AGRICULTURAL DEVELOPMENTS

Farming has been carried on in Jones County since the first settlement was made in 1820. Stock raising was the chief occupation.

2/ Logan, William N.—The Soils of Mississippi. Mississippi Agricultural Experiment Station, Technical Bulletin, No. 7.

of the early settlers, few crops were grown, and cattle were grazed on the undergrowth of the pine forests. Agriculture developed slowly and in 1880 only about 21,000 acres, or less than 5 per cent of the area of the County, was classed as improved farm land. At this time corn was the most important crop and as late as 1889 there were 5,664 acres of corn and only 2,784 acres of cotton reported.

The census reports indicate that there was little change in the acres of land in farms from 1900 to 1925, but that the percentage of improved land doubled during that period. Figure I shows the proportion of all land in farms and the improved land in farms by census periods since 1900.

As the number of farms in the County increased there was a decrease in the average size of farms, but the number of crop acres per farm remained about the same. The increase in total crop acres was due to the larger number of farms and not to an increase in the acreage operated by each man. Table 1 shows the number and average size of and tenure on farms by census years since 1900. It may be noted that in 1910 and again in 1925 when the number of farms was greatest, the percentage of tenancy was also greatest.

According to the classification made by the Census, the number of farms with 20 to 49 acres and from 40 to 59 acres has been increasing while the number of large farms has been decreasing. Presumably some parts of the larger holdings are being operated by share croppers and as such are listed as separate farms. It does not mean that the land holdings are being broken into smaller units. In 1925 there were 514 croppers reported in Jones County or 213 more than were reported for 1920. At the same time the number of owners and tenants other than croppers decreased slightly. The number of croppers

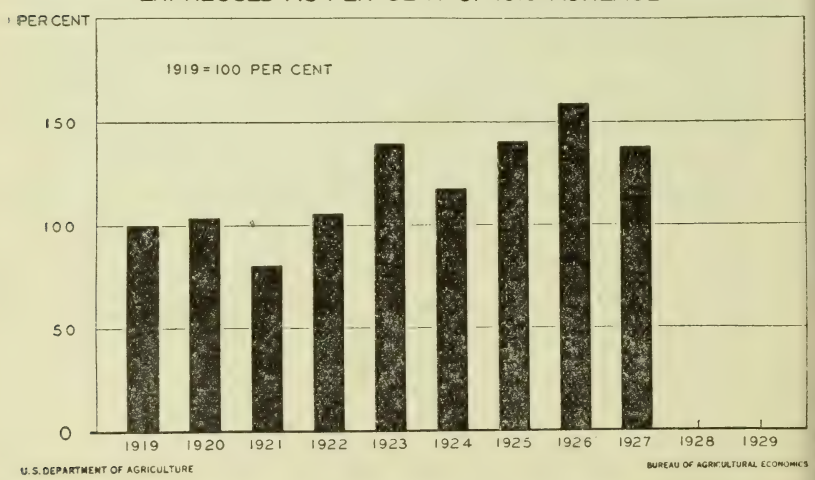

Figure II. The trend of cotton acreage in the Longleaf pine section of the state has been upward. Fluctuations may be readily accounted for by economic conditions.

is not given in the reports prior to 1920, but during the 5-year period following 1920 there seems to have been a decrease in the number of farm proprietors, and an increase in share croppers. On the basis of farm proprietors, that is, owners and tenants who own their own equipment, the average size of farm was 97 acres for both 1920 and 1925, but the crop acres per farm increased from 27.4 to 33.

Changes in Cotton Production

From 1900 to 1910 the production of cotton in the county averaged slightly more than 10,500 bales annually, but following the weevil infestation production fell away until in 1916 only 885 bales were reported. After 1919 the acreage of cotton again increased and by 1924 was greater than at any other census period. Many of the farms reported by the 1910 census and 1925 census were cropper farms, and while this is evidence of an increase of production, it does not signify an increase in the number of land holders or of separate farm units.

In 1910, just before the first ravages of the boll weevil, 11,629 bales of cotton were ginned. This figure was not exceeded until 1924 when reported ginnings amounted to 12,088 bales. The increase in the number of farms reported and the increase in the number of tenants is doubtless due to the tendency for croppers to put out small acreages of cotton during periods when the crop is profitable.

The good yields of cotton and the favorable prices obtained in recent years have stimulated the production of cotton in this section of Mississippi. Figure II shows the percentage of increase in the acreage of cotton in nine counties including Jones County. Data for separate counties are not available, but from the estimates the increase

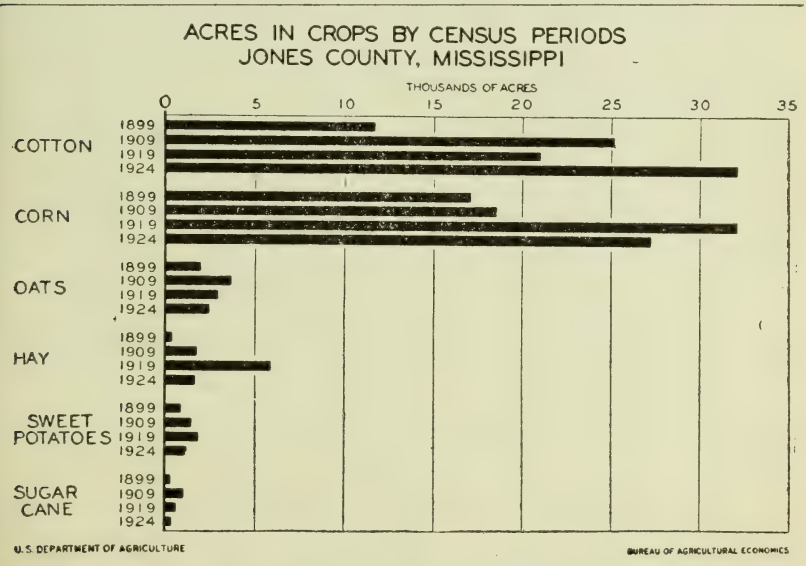

Figure III. Cotton and corn are preponderantly the major crops of Jones County in point of acreage occupied. These two crops have consistently alternated for the place of greatest acreage at the times of the last four census enumerations.

in the acreage of cotton in Jones County is similar to that for the section. Although the acreage in three of the years was less than that of the year preceding, yet the trend has been toward a larger acreage each year. No data are available for recent years, but the opinion of those interested in cotton in these counties is that the acreage has continued to increase since 1927. In 1926 the acreage was 59 per cent more than the acreage of 1919. With unsatisfactory returns from cotton in 1928 and again in 1929 the acreage may again decline, as it has done after previous unfavorable years.

Figure III shows the change which has taken place in the acreage of crops grown in each of the recent census periods. Since 1899 the cotton acreage has trebled and other crops have increased in acreage. In 1899 corn occupied a larger acreage than any other crop and made up 11 of the 21 crop acres per farm. In 1909 cotton occupied one-half of the 20 crop acres per farm, and only 7 acres were in corn. In 1919 only 8 acres of cotton per farm was reported and more land was in hay and feed crops. The next census report showed that in 1924 one-half of the 24 crop acres per farm were in cotton, only 10 acres were in corn, and a much smaller acreage in hay.

There has been less change in the number and kind of livestock than in the crops grown. As the number of farms increased there was an accompanying increase in the total number of work animals in the county. The increase of cotton and the decrease of feed crops was also accompanied by a decrease in the number of cattle and hogs. There were fewer cattle reported in the county for 1925 than for 1920.

THE FARMS FROM WHICH RECORDS WERE OBTAINED

Records of the farm business were obtained from 19 farmers in 1927 and from 15 in 1928. Eleven of the farmers kept records for the two years. These farms are located in the southwestern part of the county. The land is practically all upland and on most of the farms the surface is rolling or rough so that terracing of cultivated fields is a common practice. The soil is typical of the fine sandy loam of the area and has the common deficiencies of phosphates and nitrogen.

The farms ranged in size from 31 to 280 acres with the area in crops ranging from 19 acres on the smallest farm to 123 acres on the largest. On the average, these farms were larger than those of the county, with a total size of 111 acres of which 40 acres were in crops. Seven of the 15 farmers had one or more croppers in 1928 and 7 of the 19 farmers keeping records the previous year had croppers. These larger holdings, which have been classified in this study as single farms, would in the census classification, be rated as two or more, according to the number of share croppers. Eliminating the effect of the number of croppers, the average size of farm reported by the census for Jones County is only 14 acres less than the average for farms included in the study.

On the average, the 15 farms in 1928 had 23.4 acres in wage crops, which is practically the same as the county average per farm for 1924, and 17 acres per farm which was worked by croppers. Approximately 28 acres were in permanent pasture, most of which was unimproved cut-over land. The farms on which records were obtained

n 1927 averaged 33 acres in owners' crops and 12.5 acres grown by hare croppers. On a few of the farms, some of the land not under ultivation would not be tillable, but as a rule, most of the farms had dditional land that could be tilled by clearing of stumps and terracng. In 1927, there was no fencing law in the county and none of he woods land was classed as pasture.

Table 2.—Distribution of Land on Farms Operated by Owners or by Owners and Croppers, Jones County, Mississippi.

	Farms	Crops grown				Woods and pasture	Farmstead	Total
		Cotton	Corn	Other	Total			
	Number	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Farms in 1927								
owner operated	12	15.4	8.5	8.2	32.1	71.0	.7	103.8
Farms with croppers	7	36.0	21.4	11.2	68.6	92.5	1.1	162.2
Wage crops		13.0	11.9	9.7	34.6	.....	..	.....
Share crops		23.0	9.5	1.5	34.0	.....	..	.....
All farms	19	23.0	13.3	9.2	45.5	78.9	.9	125.3
Farms in 1928								
owner operated	8	12.0	7.0	5.9	24.9	52.6	.6	78.1
Farms with croppers	7	37.7	13.9	6.2	57.8	91.1	.6	149.5
Wage crops		9.3	7.0	5.2	21.5	.....	..	.....
Share crops		28.4	6.9	1.0	36.3	.....	..	.....
All farms	15	24.0	10.2	6.1	40.3	70.0	.6	110.9

The distribution of land on these farms is shown in table 2. Cotton and corn were the principal crops grown. "Other crops", grown on some, but not all, of the farms were oats for hay or grain, soybeans, and cowpeas. Truck crops grown for sale or for home use consisted of sugar cane for making syrup, sweet potatoes, Irish potatoes, string beans, turnips and rutabagas. Of these minor truck crops, the surplus was sold locally, or when the market was unfavorable, was fed to livestock.

The crops grown by the cropper-labor consisted of cotton primarily, with one-fourth as much corn as cotton and a small acreage of truck crops. On the land farmed by croppers, the acreage and production of garden and truck crops were relatively unimportant.

For the most part, the pastures were unimproved and the livestock on pasture were getting such native grasses as grew on the cut over timber land. With the enforcement of the fencing law, the stock no longer has access to open range and the keeping of cattle will depend more on the improvement of pasture lands on the farms.

As a source of income, livestock were of little importance on the farms on which records were obtained. Work stock consumed the greater part of the feed produced.

The livestock on the farms from which records were obtained in 1928 was practically the same as that on the farms in 1927, and the average is shown in table 3. On the farms with no share crops, two work animals per farm was most common. One farm, larger than the others and which employed more than the usual amount of hired labor, kept six animals, while two of the farms used only one each. The farms operated in part by croppers had two or more work animals, the number varying with the acreage of crops handled, or the number of croppers on the farm.

Table 3.—Livestock on Farms—Jones County, Mississippi.

	Farms	Crops	Livestock				
			Horses and Mules	Cows	Other Cattle	Hogs	Poultry
	Number	Acres	Number	Number	Animal Units	Pounds 1/	Number
Farms in 1927							
owner operated	12	32.2	2.3	2.2	1.6	387	46
Farms with croppers	7	68.8	3.8	2.8	1.8	946	66
All farms	19	45.7	2.8	2.4	1.7	594	53
Farms in 1928							
owner operated	8	25.0	1.9	2.0	.8	700	61
Farms with croppers	7	57.9	3.1	2.2	1.1	444	49
All farms	15	40.3	2.5	2.1	1.0	580	55

1/ Measured in terms of pounds of dressed pork produced.

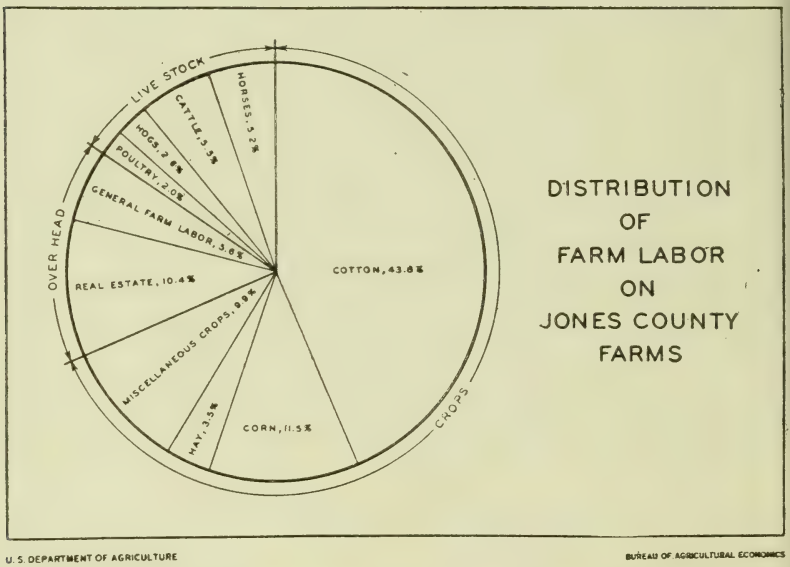

Figure IV. Nearly twice as much labor is expended on cotton as on all other crops combined. The large amount of labor on real estate is due to the state of development of the section; considerable land was being cleared and some buildings erected. There is need for more livestock enterprises.

As a result of the fencing law and the dipping program, many of the farmers in the county disposed of some of their cattle during the second year and the number of cows remaining was only enough to meet the needs of the family for dairy products. A few of the farms produced some cream for sale, but the production of dairy products for the market was uncommon in either year. Pork was produced on all farms except one during the first year of the study and on all of the farms in 1928, but the average production of pork was slightly smaller the second year. In general, pork is produced for family use only, although some dressed pork was sold. On the average, a flock of

55 head of chickens was kept, the size ranging from 15 to 125 hens. Some poultry and eggs were sold, although the production per head was low.

Typically, the family farm in this section is organized to produce 8 to 12 acres of cotton, about two-thirds as much corn, and a few acres of other crops, such as oat or soy bean hay and truck crops for home use. On a farm of this size, the livestock kept would be approximately two head of work stock, two milk cows, two or three head of young cattle, about 50 chickens, and a breeding sow with pgis.

Distribution of Labor to Enterprises

Almost one-half of the time which the operator, family labor, and hired labor worked on these farms was used on the cotton crop. Figure IV shows the distribution of this labor to the upkeep of the farm, to the crops, and to livestock during the two years of the study. Cotton used 44 per cent of the labor hours, corn 12 per cent, hay 4 per cent, and other crops 10 per cent. Only 15 per cent of the time spent in farm work was used in the care of livestock and of this, one-third was for the care of work stock. Altogether, about 16 per cent of the labor was for the upkeep of the place, including the upkeep of the farm buildings, maintenance of equipment, work done for the household, and other general work.

Figure V. A good distribution of labor is much to be desired on any farm. June and September show labor peaks on this farm while in August and December very little was done. Enterprises which would provide profitable employment for available labor at these slack seasons would greatly improve this farm business.

On the average, these farms used 3578 hours of labor in 1927 and 2842 hours in 1928. The smaller amount of labor was probably due

to the short crop of cotton in 1928 which required less labor for cotton picking and hauling.

These totals and the distribution of the man hours shown in the chart do not include the labor of the share croppers on the farms. With the share croppers, little labor is used for farm upkeep, less for care of livestock, and as cotton is the sole crop, a greater proportion of the labor of the croppers is devoted to the production of cotton.

Sources of Farm Labor

Records of the work done by croppers on share crops are not available and table 4, showing the source of farm labor on these farms, does not include that for which a crop share was given. The difference in the total hours worked in 1927 and in 1928 is caused by the variation in different farms, to changes in the season and to lower cotton yields the second year. In 1928, the number of man hours per farm ranged from 1937 hours on a small farm, the operator of which worked off the farm 940 hours, to a farm with the average acreage of crops, but dependent on family labor where 4950 hours of labor were used.

More labor was reported in 1927. In this year, too, probably because of the high yield of cotton, more labor was hired and a greater use made of family labor. On the average, the labor of the proprietor both on and off the farm was 2017 hours in 1927, and ranged from 1050 to 2996. In 1928, the average was 2084, ranging from 1289 to 2719 hours. Many of the proprietors with no outside work would have time to carry on additional farm enterprises provided the labor of the new lines of production did not conflict with the labor on cotton. The distribution of labor to different enterprises on one farm with an organization typical of those in the area is shown in figure V. On this farm the demand for labor is concentrated during the months of June and December. If necessary the work on cotton could have been spread over a longer period so that the operator and the family could have done more of the work, but the chart hows the time when the available labor was not fully employed. Enterprises which provide something profitable to do during these slack periods should be valuable additions to the farm business.

Table 4.—Sources of Farm Labor—Jones County, Mississippi—1927 and 1928

	1927	1928
Number of Farms	19	15
Proprietor labor—(hours)	2017	2084
Family labor—(hours)	1120	611
Paid labor—(hours)	597	332
Exchange labor—(hours)	36	48
Total—(hours)	3770	3075
Outside labor paid	165	233
Outside labor exchange	27	....
Total on farm	3578	2842

Farm Earnings in 1927 and 1928

Neither 1927 nor the year following would be considered normal years in the section. Crop yields were exceptionally high in 1927 and farm earnings were better than would be expected over a period of years. On the other hand, the cotton crop in 1928 was very short and farm earnings were low. Figure 6 shows the range of farm earnings in a year of exceptionally good cotton yields as compared to a year of very poor yields, and at the same time, shows the variation of farm

income on the farms for each year. In 1927 the farm income on 19 farms averaged $1132.28, but for the following year the average was only $411.42. This farm income represents the amount remaining for the operator and the farm after current expenses and the value of unpaid family labor have been deducted from the value of the production. The first year the farm income ranged from $2548.81 to $408.77. In 1928, the range was much lower, the highest income figure being $1004.19 and the lowest being $355.63 less than enough to meet the expenses and charge for family labor even with no allowance for the operator or his farm. With few exceptions those who had a high farm income had a high rate of return on investment as well. The value of the operator's labor, estimated at 15 cents per hour, averaged $302.56 in 1927 and $312.82 in 1928.

Table 5 shows a summarized financial statement of the farms on which the records were obtained for the two years. Much of the difference in the incomes of the two years is due to smaller returns from crops and livestock in 1928, less receipts from outside labor, and a much smaller increase in the value of the farm property. Cash expenses were somewhat less, and there was a smaller average charge for unpaid family labor.

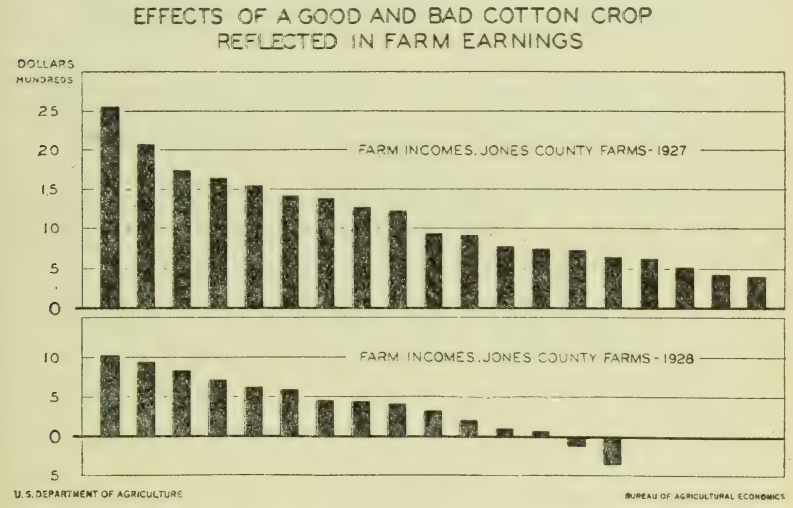

Figure VI. Where cotton is the only money crop, the farmer's welfare depends on climatic conditions. At least two sources of cash income are highly desirable on the family operated farm. Some form of livestock, fed from the farm, makes an ideal combination with cotton.

There is a greater difference between the earnings on different farms in any one year than there is between the average earnings for the two years, and it is with the difference in income on different farms and the causes for the difference in incomes that this bulletin will be most concerned. As shown in figure VI, there is a wide difference in the earnings of farms under similar conditions. These are

in part due to different systems of management, and in part to the effectiveness of the production on the farm, but as the farms grew similar crops and in practically the same proportions, there is a greater difference in the effectiveness of the production than in the kind of crops grown or in the livestock kept. This does not mean that there is no room for improvement in the system of farming followed, but that from a study of the records themselves significant differences in production methods may be noted and singled out for examination.

Table 5.—Financial Statement of Farms for 1927 and 1928—Jones County, Mississippi

	1927		1928	
Number of farms		19		15
Crop and livestock receipts	$1195.08		$854.17	
Miscellaneous receipts	303.48		138.86	
Inventory increase	580.14		82.37	
Value of items furnished the home	461.22		384.14	
Total value of product		$2539.92		$1459.54
Cash expense	1198.33		777.74	
Inventory decrease	35.70		174.93	
Value of family labor	173.61		90.72	
Total charge		1407.64		1043.39
Farm income		1132.28		411.42
Value of operator's labor		302.56		312.82
Total investment (dollars)		6299.00		5546.00
Return on investment (per cent)		13.17		1.8

Time and Materials Used in the Production of Crops and Livestock

Tables showing the hours of man labor, hours of horse work, and quantity of fertilizer used for each crop by the farmers who kept the detailed records have been published in Mississippi Experiment Station Bulletins 256 and 269. These bulletins show also the hours of man labor and the kind and amount of feed used in the production of livestock of each farm. The records show a wide variation in the use of labor on crops and livestock, the use of fertilizer and yields of crops and the amount of feed for production from livestock. Much of this variation is due to difference in farm practices on different farms. Cultural practice on cotton is more nearly standardized than on other crops, but even here there is a wide range in the quantity and kind of fertilizer and the variety of cotton grown. For crops such as soybeans and cowpeas for roughage, which are new to the area and are not familiar to all farmers, there is little uniformity of practice on different farms and various methods are often followed on the same farm for different fields or for different years.

The crops with the exception of cotton were used in most cases as feed for work stock. Cattle and hogs, until 1928, were pastured on the open range and little care given to breeding and feeding. Methods of production under these circumstances are not comparable to those which must be followed if the livestock are to be profitable under the present situation of farm pastures and feeding. In 1928, all the farmers in the county had not adopted new methods to meet the changed conditions.

The following tables show the average amounts of the items of

expense used and the production obtained from crops and livestock,

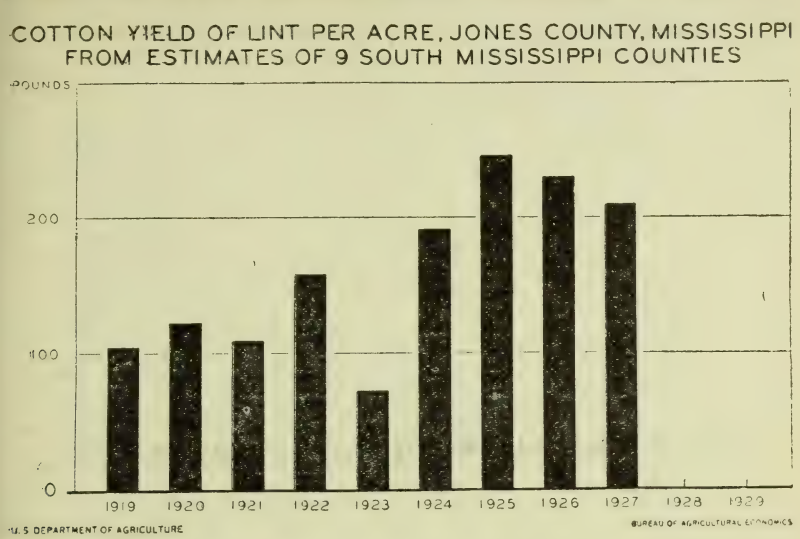

Figure VII. The trend has been upward in cotton yield per acre in Jones County. This is doubtless due to proper terracing, the use of fertilizer and, perhaps, the growing of more improved varieties.

Cotton

The advantages in production and marketing of cotton are such that on most farms this crop is practically the only source of farm cash receipts. Adapted truck crops often find a very poor market and are, for the most part, grown for use by the farm family. Such feed crops as are grown are nearly all needed for work stock, and on most farms very few animals or livestock products are sold. Under these circumstances farm earnings are dependent on the success of the cotton crop and on the price received. Cotton production has a large number of hazards and an ideal farming system even for this section would include some other important source of income, but cotton is, and under present conditions, will continue to be the pivot of the farming system in this section. From 1924 to 1927 yields of cotton in this section were higher than for any of the five years preceding. The estimated yield for this section is shown in figure VII. Since 1927 the yield has been low. The profitable farms during the four-year period, 1924 to 1927, were those with the highest acreage in cotton, but with only average yields of cotton, the need for other sources of income is apparent.

Cotton yields on the farms from which the farm records were obtained were higher than the average for the state in 1927, but these high yields were obtained only through heavy applications of fertilizer. In 1927, the average per acre yield of cotton for Mississippi was estimated at 194 pounds of lint cotton and in the same year the average yield on the farms was 298 and ranged from 167 pounds to 519 pounds.

In 1928 the average yield for the state was 176 and on 15 farms in the county, even with heavy fertilization the average yield was only 123 pounds per acre, the range being from 62 to 200 pounds.

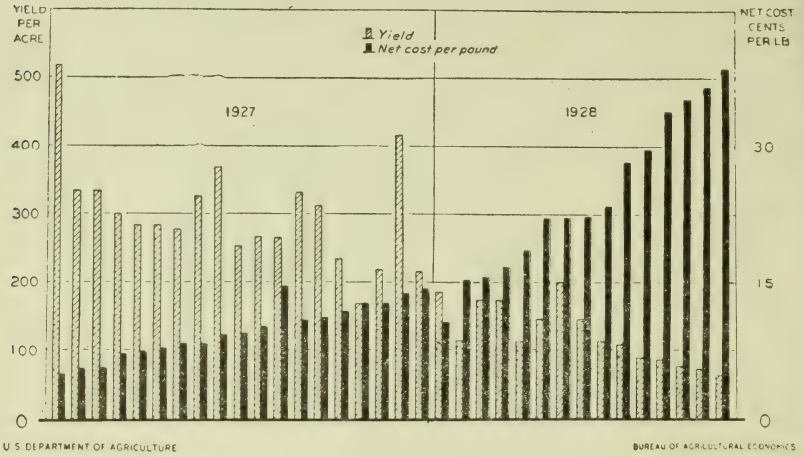

Figure VIII. The yield of lint per acre has a striking influence on the net cost per pound as shown by the results of the study in both 1927 and 1928. There is more opportunity for the individual farmer to reduce his costs than there is for him to increase the price of cotton.

The cost of producing a pound of cotton varied as widely as did the yields and in general the higher yields were accompanied by the lower cost per pound. This is illustrated by figure VIII, which shows the net cost per pound with the yield per acre for the same farms. The shaded bars represent the yield and the solid bars represent the net cost per pound of lint. On the light soils characteristic of the area good yields are not obtained ordinarily without the addition of phosphates and nitrogen to the soil. In a normal season the application of fertilizer will more than repay its cost through increased yields and it is through the increased yields that economic production is obtained. But high yields obtained at an abnormally high cost may not result in a low cost per pound of cotton.

The records indicate that the farms with high yields generally had no higher costs per acre for labor and materials than the farms with low yields. The farm with the highest yield per acre and the lowest cost per pound of cotton in 1927 had a gross cost only slightly higher than the average of all farms, and after a credit for the seed was made the net cost per acre was less than the average on all farms. At the other extreme, one farm with a yield of 418 pounds per acre had abnormally high fertilizer and labor costs which resulted in one of the highest costs per pound of cotton. This farmer expended almost double the average amount of man and horse work and double the average amount of fertilizer with yields not enough higher than the average to justify this higher cost.

Table 6 shows the average charge for the items going into the

production of cotton. Man labor was charged at a uniform rate of 15 cents per hour and the cost of the horse work was charged at rates determined for each farm. The average expenditure for fertilizer was higher in 1928 than for the previous year, but the ginning cost which depends on the yield was lower. The charge for the equipment on these farms was estimated at two cents per hour. In computing these costs no charge was made for the use of the land. The cost of labor and materials alone averaged $35.70 in 1927 and $31.05 in 1928. Of this the cost of the fertilizer, ginning cost, and a part of the labor charge represented the cash expenditure of the farmer.

Table 6.—COTTON: Cost Per Acre of Labor and Materials
Jones County, Mississippi—1927-1928

Year	Number of Farms	Cotton per farmer	Charge for man labor	Charge for Horse work	Cost of fertilizers	Cost, seed, ginning, & of equipment	Total cost per Acre
		Acres	Dollars	Dollars	Dollars	Dollars	Dollars
1927	19	14.2	18.17	6.44	5.36	5.73	35.70
1929	15	10.7	15.28	5.45	6.48	3.84	31.05

High yields of lint are accompanied by high seed yields which, when the value of seed is deducted from the gross costs, lead to a lower net cost of the lint per acre. In arriving at the cost of producing the lint per pound the value of the seed was deducted from the gross cost per acre as shown in table 7.

With more labor used in picking the crop and higher ginning costs in 1927 the gross cost per acre was somewhat higher than the average per acre in 1928. This higher gross cost was balanced by the higher seed credit for the first year so that the net cost per acre was practically the same although the crop in 1927 was duoble that obtained in 1928. The net cost per acre for man labor, horse work, equipment and materials averaged about $27.00 both years. With the small yield in 1928 the net cost per pound averaged more than double that of the previous year. This in itself explains the low earnings on these farms the second year of the study, and illustrates the hazard of depending on cotton as the sole source of income.

The comparison of the average for the two years bears out the impression gained from figure VIII; that high yields are necessary to produce cotton at a low cost, but high yields in themselves do not necessarily lead to economical production or to larger farm profits. The acreage that was handled and the cost involved per acre should be considered with the yield and the cost.

Some illustrations of the effect of the acreage handled, yield per acre, and the cost per pound on the profits from the enterprise can be gained from the farm data given in Mississippi Experiment Station Bulletins 256 and 269. The farm which had the highest yield and the lowest cost per pound in 1927 had a crop of 8.1 acres of cotton which yielded 519 pounds of lint per acre at a gross cost per acre of $42.31 and a net cost per pound of 4.91 cents. A second farm with a gross cost per acre $43.23 had a crop of 29.2 acres with a yield of 369 pounds of lint per acre and showed a net cost of 9.23 cents per pound. Assuming that both crops were sold for 20 cents per pound, approximately the December first price for that year, the first farm would have a net return of 15.1 cents a pound as compared to 10.8 cents a

pound on the second farm. Yet the larger acreage on the second farm and larger total production of cotton would give a total return over the producing costs of $1164.00 or almost double the return of $635 on the smaller acreage with higher yield. After allowing a charge of $5.00 per acre for the use of the land, the second farm would still have a return of $1018.00 as compared to a net return of $595.00 to the operator of the smaller crop.

In this illustration the labor and fertilizer costs were practically the same per acre on both farms and the increase in the total net returns is due to the larger acreage. But with similar expense there is no apparent reason why the yield per acre on the larger acreage should be less than that on the small acreage.

Where the same acreage is grown on two farms the one with the higher yield per acre may make the larger total profit even though the yield is obtained at a higher cost per pound because the farm with the higher yields would have the larger amount of cotton for sale. An illustration of this may be drawn from the 1927 records. One producer who had 9.8 acres of cotton obtained a yield of 252 pounds per acre at a gross cost per acre less than the average, or $29.13. His net acre charge was $23.31 and the cost per pound was 9.25 cents. Another producer grew 9.6 acres of cotton at a gross cost of $46.80 per acre, but which yielded 331 pounds of lint. The net acre cost on this farm was $35.49 and for each pound of lint was 10.72 cents. At 20 cents per pound the first would have gained 10.75 cents on 2470 pounds or a net of $265.52; the second although gaining only 9.28 cents per pound would have this on 3178 pounds, or a total of $294.92. The land charge in each of these instances would have been about the same.

Table 7—COTTON: Net Cost Per Acre and Per Pound of Lint

Year	Number of farms	Cotton per farmer	Gross cost per acre	Seed credit per acre	Net cost per acre	Av. yield per acre	Av. cost of lint cot. lab. & mat. per pound
		Acres	Dollars	Dollars	Dollars	Pounds	Dollars
1927	19	14.2	35.70	8.40	27.30	298	.09
1928	15	10.7	31.05	4.08	26.97	123	.22

These illustrations show that earnings from the cotton enterprise may be increased through lower per acre costs of producing cotton, which means a more economical use of the items of cost; by lowering the cost per pound through larger yields even though it means an increase in the acre cost of production; or by an increase in the acreage handled on the farms.

Man Labor on Cotton

Cotton as it is grown in this area uses a comparatively large amount of man labor, particularly at chopping and picking time. This heavy demand on the operator's time for chopping and picking limits the acreage that can be handled with a given labor supply. It has been shown that 44 per cent of the total labor on these farms and two-thirds of the labor on owned crops was on cotton during the years of the study. In 1927 the amount of labor on an acre of cotton averaged 121.1 man hours and even with the light crop of 1928 an average of 101.9 hours was used per acre.

Table 8 shows the distribution of this labor to the different opera-

tions performed in producing the crop. Land preparation averaged 7.6 hours in 1927, but the unfavorable season in 1928 caused the repetition of much of the early work and 10.0 man hours were used in preparing an acre for planting. Picking cotton required almost 50 per cent of the total labor in 1927. This and chopping the cotton, which is another time-consuming operation, is all hand labor. The amount of time required for picking depends somewhat on the yield obtained; yet there is so much variation in the rate at which the different workers pick cotton that the records show no consistent relation between the yield and the time required for picking. With the good yields obtained in 1927 the pounds of lint cotton picked per hour ranged from 2.5 up to 10.0 pounds.

With the light yields of the second year the range was from 2.2 to 7.8 pounds per hour. Much of this variation is undoubtedly due to the employment of women and children for picking cotton on some of the farms. The same explanation can be given for the variations in the labor of chopping and hoeing. In estimating costs the labor of women and children was charged at the same rate as the labor of others.

The labor of preparing the land depends on the number as well as the kind of operations performed. The usual operations are breaking early in the season, bedding and fertilizing, followed by harrowing and planting. The least labor was used on those farms where the field was bedded without previous breaking of the ground and where two horses were used in seed bed preparation.

Hauling and applying fertilizer required as much as 12 hours per acre, but in most cases these operations required 3 to 5 hours. Harrowing and planting required about the same amount of time, with somewhat less variation.

Cultivation is done entirely with one-horse implements, although two-horse cultivators could be used on the larger and more level fields. This sugests a possibility of reducing the amount of man labor used in cultivation by replacing the one-horse with two-horse cultivators. With this change in practice the average of 18 hours per acre for cultivation could be reduced by approximately one-half on the farms where the fields are comparatively large and level.

Some saving in time could be made even on the smaller fields and those with narrow terrace rows. The range in the amount of labor used in cultivating cotton was from 10 to 30 hours and depended on the number of cultivations given as well as on the rapidity of the work.

Some of the farms used twice as much labor on cotton as did others. The type of soil and the prevalence of weeds in the fields required more labor on some than on other farms and the time of performing the operations and the seasonal conditions of 1928 also affected the labor necessary. A large amount of labor spent in developing the seed bed may reduce the later work of cultivating and hoeing, and with careful or thick planting the need for replanting may be avoided. Fields on hillsides may require more time for cultivation than those on level land where there is less danger from erosion.

Table 8. COTTON: Man Labor and Horse Work Per Acre by Operations
Jones County, Mississippi

Item	1927		1928	
Number of farms	19		15	
Acres per farm	14.3		10.7	
	Man labor	Horse work	Man labor	Horse work
	Hours	Hours	Hours	Hours
Land preparation	7.6	10.5	10.0	15.9
Haul and apply fertilizer	3.9	2.6	5.8	4.3
Harrow and Plant	3.9	3.9	4.6	4.7
Cultivate	18.2	18.3	20.1	20.2
Hoe and chop	18.1		31.5	
Pick and haul to gin	69.4	4.4	28.3	1.9
Total	121.1	39.7	101.9	47.0

The season in which the work on cotton and other crops is done is shown in figure IX. On these farms some land was plowed early in February and bedded just previous to planting. Fertilizing, harrowing and planting is completed by the latter part of May, while hoeing, chopping and cultivating continues until the latter part of July. This is the farmers' busiest season. Picking and hauling is usually done in September or October.

The horse work on cotton averaged 39.7 hours in 1927 and 47.0 hours in 1928. As a general rule the farms with the high man labor requirements also used more than the average amount of horse work. Two-horse plows were used in preparing the seed bed on some of the farms, but the work of cultivation was with one-horse units. The factors which tend to increase the necessary amount of man labor on cotton also tend to increase the amount of the horse work required where one-horse implements are commonly used.

Fertilizer on Cotton

As the fertilizer is the largest single item of cash expense on most of the farms there is a temptation to use an amount too small or a grade of fertilizer too low to obtain the best results. General recommendations for this area are for the use of 500 to 600 pounds of a fertilizer equivalent in composition to a 4-8-4 mixture, (see footnote) yet only one operator on the route used more than 500 pounds of fertilizer on his cotton. The average amount of fertilizer used is shown in table 9. In 1927 the highest yield was obtained with an application of 100 pounds of nitrate of soda, 100 pounds of superphosphate and 100 pounds of kainit per acre. Another farm with economical production of cotton applied fertilizer at the rate of 200 pounds of superphosphate, 100 pounds of cottonseed meal and 125 pounds of calcium cyanamid. On another farm good results were obtained from the use of 309 pounds of nitrate of soda alone. Only one farmer in 1927 used no fertilizer at all.

In 1928 the highest yield was obtained from an application of 106 pounds of nitrate of soda, 223 pounds of superphosphate and 60 pounds of kainit. Nearly all of the fertilizers used consisted of ni-

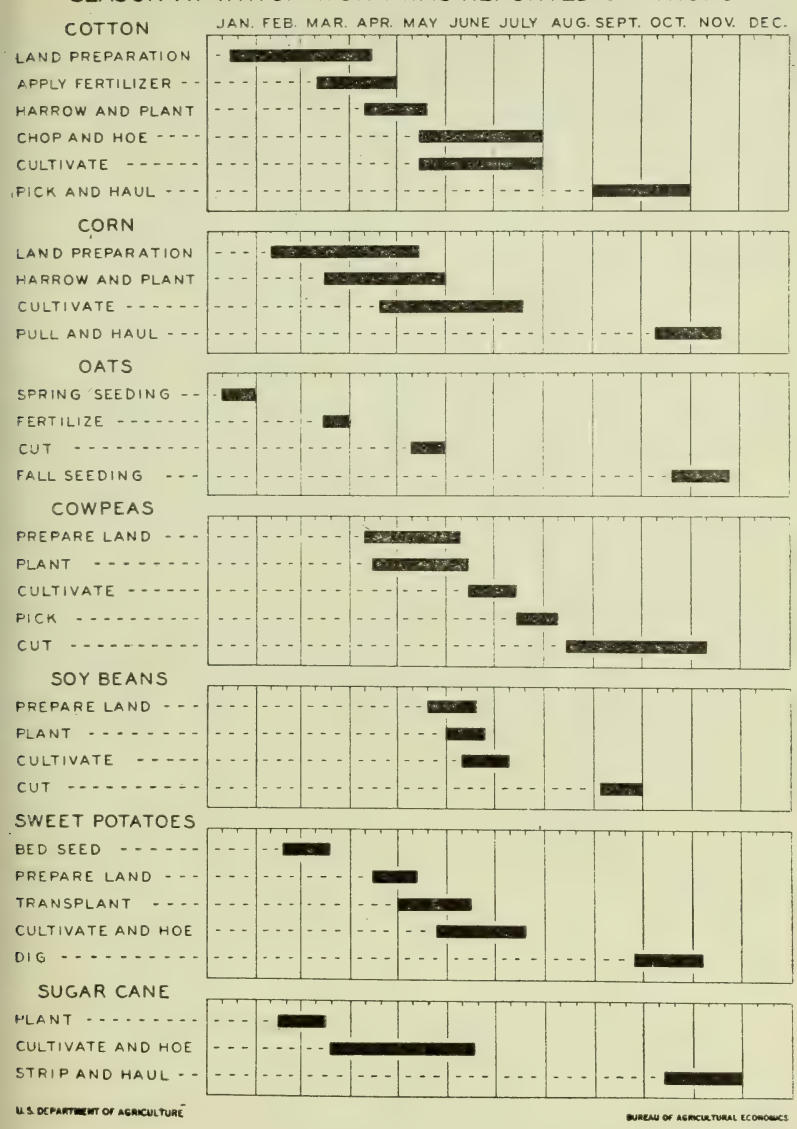

Figure IX. The selection of crops such that several do not need attention at the same season constitutes a real problem for the farm operator. A chart such as this should aid in planning the cropping system.

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trates and phosphates and many contained some potash. The most

common formula for the mixed fertilizers used was 4-8-4.

Table 9—COTTON: Fertilizer and Seed Used Per Acre—Jones County, Mississippi

Year	Number of farms	Acres per farm	Seed	Fertilizer						Yield per Acre
				Phos-	Nitrate of soda	Cotton seed meal	Mixed	Other	Manure	
			Bu.	Lbs	Lbs	Lbs	Lbs	Lbs	Tons	Lbs
1927	19	14.3	1.4	138	63	25	94	15	.04	298
1928	15	10.9	1.1	114	71	-	177	28	.07	123

Corn

Corn is next in importance to cotton on the farms in this section and although not grown for a cash crop it is the principal source of feed grain. The acreage of corn averaged only 9.8 acres per farm in 1927 and 7.01 acres on the farms the second year. The smallest acreage on any farm in 1927 was 3.9 acres while the largest acreage of owner's corn was 24.0 acres. Most of the farmers grew between 8 and 14 acres of corn. As a rule the grain produced is little more than sufficient for the needs of the work stock and little is left for the feeding of the other classes of livestock. Yields of corn in this section are generally low unless the land is fertilized and although corn does not respond as readily to fertilizer as does cotton, yet with a reasonable application of fertilizer, 30 bushels per acre can be expected. Increases in the number of livestock on the farms will require a larger production of feed and corn is the most dependable grain crop for the section.

The cash costs per acre are less for corn than for cotton. Less fertilizer is used and there are no cash charges connected with the harvest of corn. Even with no land charge and with labor charged at 15 cents per hour, the average cost of labor, horse work, fertilizer and equipment used in the production of corn in 1927 amounted to 69 cents per bushel and in 1928 to 76 cents per bushel. The yield was practically the same each year although more fertilizer was used on the farms in 1928 and, as shown in table 10, the per acre and per bushel costs were somewhat higher.

Table 10.—CORN: Cost Per Acre and Per Bushel of Labor and Materials Jones County, Mississippi

Year	Acres per farm	Man labor	Horse work	Fertilizers	Seed & machinery charges	Gross cost per acre	Yield per acre	Cost per bushel
		Dollars	Dollars	Dollars	Dollars	Dollars	Bushels	Dollars
1927	9.8	6.34	5.54	2.86	1.01	15.75	22.50	.69
1928	7.0	7.05	5.28	4.05	1.17	17.53	23.20	.76

The yield per acre ranged from 11 bushels to 51 bushels per acre in 1927 and from 9 to 48 bushels per acre in 1928. The variation is due to differences in the condition and the fertility of the soil, the addition of fertilizers, and to the care of the crop. There is doubtless a tendency to neglect the corn crop and work the cotton at times when both are needing attention.

It may be said that on most of the farms in the county corn can not be grown without the use of fertilizer. It may also be said that

NOTE: Throughout this bulletin, fertilizer formulas will be stated in the order: nitrogen, phosphorous, potash.

adequate cultural practices should follow, if the value of fertilizer is to be regained in the crop. For instance, one farm in 1927 applied fertilizer valued at $8.72 per acre, used more than the average amount of labor and made 51 bushels of corn per acre at a cost of 51 cents per bushel for labor and materials. Another farm on which the value of the fertilizer applied was $8.31, but on which little labor was spent in preparing the land for the crop or in cultivating obtained only 16.5 bushels of corn per acre at a cost of 85 cents per bushel. Other instances could be cited in which a great amount of man labor was spent on the crop with small returns because of low soil fertility. The addition of fertilizer would have increased the chances of obtaining a good yield and favorable returns for the labor and other items expended.

Man Labor on Corn

On the average, 42.2 hours of man labor were used in producing an acre of corn, making 22.5 bushels in 1927 and 47.0 hours were used for a yield of 23.2 bushels in 1928. The amount of man labor is given by operations in table 11. The operations which require the greatest amount of time were cultivating, land preparation for planting and pulling and hauling.

The most common method of preparing the seed bed was by breaking early in the year, bedding and harrowing. On some farms the land was disced before or after breaking. Those farms on which all of these operations were performed had a high use of labor. On other farms some labor was saved by omitting one or more of these operations. Where the corn land was broken and later bedded the man labor of preparing the land amounted to 15 or 20 hours per acre, but on farms where the land was bedded without breaking or was broken and not bedded the labor of preparing the land was much less, amounting to 8 to 12 hours per acre. One operator planting in a center furrow with neither breaking nor bedding used only 5 hours per acre in preparation for planting. The yield obtained on this farm was the lowest of all on the route.

The number and type of operations necessary for properly fitting the soil for planting will depend on the condition of the soil, the amount of weeds and trash, and the preceding crop. It seems likely that, with clean cultivation on preceding crops, one of the operations, either breaking or bedding, may under ordinary conditions be dispensed with. The fields should be put in good tilth before planting even though more labor is required or, as in the case cited above, low yields will probably be obtained.

Cultivation of corn accounted for approximately one-third of the total labor on the crop and as cotton requires cultivation at the same time there is a likelihood that corn will be neglected in favor of the cash crop. The cultivation was done with one-horse cultivators which requires as many hours of man labor as of horse work. On some of the farms there is an opportunity to reduce the time of corn cultivation through the use of two-horse cultivators. As this conflict with cotton is one limit to the corn acreage a means of reducing the labor of cultivation by one-half would permit an increase in the corn crop on many farms.

Pulling and hauling requires about one-fifth of the total labor on

corn; and although the season when this is done is not a particularly busy one, still some time could be saved by combining the work of pulling and hauling, rather than by pulling and piling the corn in the field and hauling later.

Figure IX shows the seasonal distribution of labor on corn. After the preparation of the land the range in dates of planting is from March 15 to June 1. Cultivation comes at the season of cultivation and hoeing cotton. Corn is generally harvested after the cotton crop is cared for.

The horse work on corn averaged 36.8 hours per acre in 1927 and 45.5 hours in 1928. For 1928 the use of horse work on corn ranged from 23 to 87 hours. Most of the horse work was used in preparation of the land for planting and in cultivation. The use of two-horse implements for these operations would not materially increase the hours of horse work needed although the man hours would be less. In 1927 one farmer used a tractor in the preparation of his land and a number used trucks for hauling.

Fertilizer on Corn

As with cotton, the cost of fertilizer is the largest cash item in producing corn. The cost of fertilizers used per acre on corn in 1927 average $2.86 and on one farm the cost of fertilizer was $8.72. All except four of the 19 farms used fertilizer on corn. In 1928 all farms but one applied fertilizer to corn and the average cost per acre was $4.05. Nitrate of soda and superphosphate are the fertilizers commonly used although some farmers applied a mixed fertilizer and in 1927 cottonseed meal was used on a number of farms. Quick acting fertilizers are not as essential for corn as for cotton; and good results with corn may be obtained from the use of manure or cottonseed meal. Farmers with livestock would find feeding the cottonseed meal and applying the manure, to be a more profitable practice than to apply the cottonseed meal directly to the crop. Table 12 shows the average amounts of fertilizer used on corn for the two years of the study. The liberal applications of fertilizer on a number of these farms doubtless accounts for yields above the average for the section. The fact that good yields of corn are obtained without fertilizer on the more fertile bottom land or on land that has been previously fertilized heavily should not be interpreted to mean that fertilizer on corn may be dispensed with.

Heavy applications of fertilizer alone are not enough to insure good corn crops. Corn land on which fertilizer has been applied should be well cultivated to give the crop the best opportunity for growth. Soybeans, cowpeas, or oats planted late with the corn will make use of the residual fertility.

Table 11.—CORN: Man Labor and Horse Work Used Per Acre—Jones County Mississippi

Item	1927	1928
Number of farms	19	15
Acres per farm	9.8	7.0
Yield per acre, bushels	22.5	23.2

	Man labor	Horse work	Man labor	Horse work
	Hours	Hours	Hours	Hours
Land preparation	9.2	14.6	11.2	17.7
Haul and apply fertilizer	2.5	1.3	3.2	2.6
Harrow and plant	2.7	2.6	5.1	4.9
Cultivate	13.6	13.7	15.1	15.3
Hoe	4.5	.....	4.1	.....
Pull and haul	9.7	4.6	8.3	5.0
Total	42.2	36.8	47.0	45.5

Table 12.—CORN: Seed and Fertilizer Used Per Acre—Jones County, Mississippi

Year	Number of farms	Acres per farm	Yield per acre	Seed	Fertilizer					
					Super-phos-phate	Nitrate of soda	Cotton seed meal	Other	Total	Barn-yard manure
			Bu.	Lbs	Lbs	Lbs	Lbs	Lbs	Lbs	Tons
1927	19	9.8	22.5	7.8	77	49	39	5	170	.03
1928	15	7.0	23.2	6.9	84	100	4	35	223	.01

Good yields of corn are probably more difficult to obtain than are good yields of cotton. Fortunately, land which gives best results for corn is often not well adapted to cotton. By planting the low and more fertile fields to corn and fertilizing when needed, profitable yields of corn may be obtained. Few farms grow sufficient grain for the livestock now carried and means of economically increasing the production of corn on these farms should be reflected in more profitable livestock enterprises.

Hay

Crops other than cotton and corn have a place of minor importance in the farming system of Jones County. Oats is the only small grain seeded and on the 34 farm records only one oat crop was cut for grain. Fall seeded oats, pastured during the winter and cut for hay the following summer is the principal, and probably the most dependable hay crop. Other crops grown and cut for hay are cowpeas and soybeans either planted in drills or sowed broadcast. A greater use of these legumes would provide a means of improving the common cropping system. Other crops grown for hay were lespedeza and mixtures of soybeans or cowpeas with sorghum.

In 1927 records of hay production were obtained on 12 of the 19 farms, but some farmers with small acreage did not keep complete records of the crops. In 1928 records on hay production were obtained on only 7 of 15 farms. On some farms no hay was produced.

The difficulty of curing hay and the long growing season which leads farmers to depend on pasture for practically the entire year are probably responsible for the small hay acreage, but from the standpoint of producing feed for livestock and improving the soil, more hay, particularly legumes and cover crops used for hay or pasture, is needed.

Table 13 shows the possibility of producing hay in this section and although the records for 1927 indicate a high cost per ton, still the greater part of this charge is for man labor and horse work. Some of the soybean crops were fertilized as were also two crops of oat hay and one crop of cowpeas. Seed is the largest item of cash outlay.

Of the four crops of cowpeas, some seed was gathered from three of the crops, in one case amounting in value to $12.17 per acre. This seed, which was gathered by hand, increased the charge for man labor; but the value of the seed undoubtedly helped in reducing the computed cost per ton of hay. Two of the cowpea crops were drilled and cultivated; the other two were sown broadcast. All of the soybean fields were drilled and cultivated. In 1927 the oat crops averaged only .39 tons of hay per acre, but in 1928 the average yield was .99 tons per acre, and in this year the computed cost was less than half of that for 1927.

Less labor is required for oat hay than for soybeans or cowpeas.

Table 14 shows the labor on these hay crops by operations. The methods of handling hay crops differ on different farms and the average of so small a number of records cannot be used as a guide in planning production requirements. The labor necessary to prepare the land was practically the same for all crops whether oats or legumes. Less labor is used on the average in broadcasting oats than in planting peas or soybeans, yet one crop of cowpeas seeded broadcast required only 1.5 hours per acre. The cowpea crops which were cultivated required 3.3 to 3.4 hours per acre for this operation which is practically the same as the time for cultivating the soybean crops except that on one soybetn hay crop 22.6 hours were expended in cultivation alone. Less labor is required in harvesting oat hay than for cowpeas, soybeans or mixtures of these; as the legumes must be cured on racks or tripods.

Table 13—HAY: Cost Per Acre and Per Ton—Jones County, Mississippi—1927

Item	Cowpeas	Soybeans	Oats	Other mixed
Number of crops	4	5	4	3
Acres per farm	3.3	2.0	5.0	7.4
Labor & material charge per acre (dol)	16.26	17.31	9.10	12.03
Seed credit (dol)	4.90	.....	.....	.....
Yield per acre (Tons)	1.00	1.21	.39	.68
Cost per ton (Dollars)	11.36	14.31	23.33	17.69

Table 14—Man Labor on Hay by Operations—Jones County, Mississippi

Item	Cowpeas	Soybeans	Oats	Mixed
Number of crops	4	5	4	3
Acres per farm	3.3	2.0	5.0	7.4
Man labor—(hours)				
Land preparation	11.6	8.1	10.5	9.3
Plant	6.0	5.1	1.6	3.0
Fertilize		1.1	.4	....
Cultivate	1.5	6.6	....	.1
Harvest	34.0	20.0	7.1	11.0
Haul	2.8	5.2	....	5.2
Total hours per acre	55.9	46.1	19.6	28.6
Yield per acre (Tons)	1.01	1.21	.39	.74

Table 15—HAY: Horse Work by Operations—Jones County, Mississippi—1927

Item	Cowpeas	Soybeans	Oats	Mixed
Number of farms	4	5	4	3
Acres per farm	3.3	3.3	5.0	7.4
Horse work (hours)				
Land preparation	8.8	7.3	21.6	15.3
Plant	4.8	7.0	.3	3.0
Cultivate	1.5	6.5	....	1.3
Harvest	21.5	14.1	5.3	11.8
Haul	2.1	5.6	....	3.3
Total horse work	38.7	40.5	27.2	34.7
Yield per acre (Tons)	1.01	1.21	.39	.74

The yield of hay from cowpeas ranged from .66 to 1.48 tons in 1927. Soybeans yielded from .70 to 1.75 tons per acre. The oat yield ranged from .30 of one ton to .46 in 1927, but the next year ranged from .53 to 1.54 tons per acre. One crop of lespedeza in 1928 yielded 1.5 tons per acre and, including 8 hours per acre clipping weeds, required only 29 man hours of labor per ton for cutting and baling the crop. This crop of lespedeza was the most profitable of all hay crops for the two years, but such yields occur only on moist lands or during wet seasons.

The large amount of man labor used in producing hay and the small yields are the chief reason for the apparent high cost of hay per

ton. Usually the acreage of hay is too small to justify the use of much horse-drawn or labor saving machinery and often the fields are small and irregular so that machinery cannot be used to advantage. Some labor was saved on cowpeas by sowing them broadcast, but whether or not this is a practical way to seed will depend on the condition of the soil and the prevalence of weeds. It seems probable that drilling and cultivating soybeans and cowpeas reduces the risk of losing the crop and reduces the amount of seed required.

Table 15 shows the amount of horse work on hay. The demand for horse work comes principally at the time of preparing the land and seeding and again at harvest time.

In considering the possibility of increasing the acreage of hay, factors other than the labor and materials expended and the tonnage obtained should be considered. Oats not only provide winter pasture, but serve as a cover crop in retaining residual fertility in the soil. The legumes improve the fertility of the soil and their effect on the following crop should be considered. Lastly, with a liberal allowance of good roughage to work stock and cattle, some saving in grain to workstock should be effected and the way opened for an increased production of livestock products for sale.

Sweet Potatoes

Sweet potatoes were grown on all of the farms, but of the cooperating farmers only 9 in 1927 and 5 in 1928 kept records in detail of their sweet potato crop. Because of the high yield per acre, sweet potatoes are an important crop in the area even though the acreage per farm is small. With this crop, the expenses for fertilizer and seed constitute a small part of the total charge for production, man labor and horse work being the important items of cost.

Table 16 shows the average value of the items per acre on the farms keeping records in the two years. The charges for man labor and horse work amounted to 75 per cent of the total labor and material charges. There is a wide range in the yields and in the charges per acre, but high charges are not always associated with high yields. These variations give a range in cost per bushel of 20 to 55 cents in 1927 and from 27 to 76 cents per bushel in 1928. These costs do not include charges for the use of the land or for marketing.

Some fertilizer was applied on all except one field in each year. In 1928 one farm on which fertilizer valued at $18.69 was applied per acre obtained an acre yield of 283 bushels of potatoes. Another with no fertilizer obtained a yield of 185 bushels per acre. On most of the fields, fertilizer is needed to obtain good yields and a high per cent of marketable potatoes.

Table 16—Sweet Potatoes: Cost of Labor and Materials Per Acre—Jones County Mississippi

Year	Number of farms	Acres per farm	Items of Cost					Yield per acre	Cost per bushel
			Man labor	Horse work	Fertilizers	Machinery & seed	Total		
			Dollars	Dollars	Dollars	Dollars	Dollars	Bushels	Dollars
1927	9	.80	21.15	9.60	3.54	6.38	40.67	141.0	.29
1928	5	.56	18.38	8.43	4.36	5.69	36.86	97.0	.38

Table 17.—Sweet Potatoes. Man Labor and Horse Work Per Acre by Operations
Jones County, Mississippi

Item	1927		1928	
Number of farms	9		5	
Acres per farm	.80		.56	
Yield per acre—(bushels)	141		97	
Time for operations	Man labor	Horse work	Man labor	Horse work
	Hours	Hours	Hours	Hours
Land preparation	25.3	19.5	26.8	26.1
Transplant	19.9	.....	21.1	.....
Cultivate and hoe	21.9	12.6	15.3	12.9
Dig	73.3	39.4	59.3	31.4
Total	140.8	71.5	122.5	70.4

Table 17 shows the use of man labor and horse work by operations on this crop. There is a wide variation in the amount of labor expended, depending on the condition of the soil and the amount of hand labor used, yet the average amount of labor expended each year up until harvest time was practically the same both years. For sweet potatoes the land is carefully prepared and bedded, requiring about 2.5 days of man labor and horse work per acre. Transplanting the slips requires approximately 2.5 days more of man labor. Digging is usually done largely by plowing out and picking up by hand and requires approximately 50 per cent of the total amount of labor on sweet potatoes. The fields on which the records were obtained varied in size from a quarter of an acre to two acres. Smaller crops of potatoes, grown on other farms, were not included in the table, but were lumped with the truck and garden crops.

Figure IX shows the season of the year during which the labor on sweet potatoes is done. The conflict of the labor with cotton and the limited market for the product tends to restrict the acreage in potatoes. It is very doubtful if the small acreages grown would justify the use of more labor saving machinery on these farms.

Sugar Cane

A number of the farmers of the route grew some cane for syrup, and while much of this is used in the home, a surplus for sale was produced on a few of the farms. Land suited to the production of cane is limited, and the crop demands heavy expenditures of labor and fertilizer. Sugar cane is usually grown on low and fertile plots of ground and although the expenses of growing the crop and making syrup are heavy, the acre yield and value of the product make this a profitable enterprise where the land is suited to the crop.

Records were obtained on 6 crops in 1927 and on 4 in 1928. These were all small plots averaging about one-half acre in size. In addition to having select soil the crops were fertilized heavily. The average value of the fertilizer used per acre amounted to $11.79 in 1927 and to $5.24 in 1928. The value of the seed cane planted and a small charge for the use of machinery averaged $33.36 per acre in 1928 and not all of the fields were seeded. The charge made for the seed cane is approximately one-half of the cost of actually planting an acre as in this section two crops from one planting are expected. The crop should be credited with the cane used for the next year's crop which was valued at $28.10 in 1927 and $34.59 in 1928. Growers of cane have the al-

ternative of making the crop into syrup or of disposing of a part of the crop as seed cane for the next year's planting.

Table 18 shows the hours of man labor and horse work that were used per acre on the cane grown. This does not include the labor of making the syrup which was estimated in the first progress report as about one-half hour for each gallon of syrup. Where the syrup is made on the toll basis, one-fourth of the syrup is given for the making.

Table 18.—Sugar Cane. Man Labor and Horse Work Per Acre—Jones County, Mississippi

Item	1927		1928	
Number of crops	6		4	
Acres per farm	.55		.40	
Yield per acre—(gallons)	110		129	
Time on operations	Man labor	Horse work	Man labor	Horse work
	Hours	Hours	Hours	Hours
Land preparation and planting	28.8	26.0	47.8	15.1
Fertilizing	7.5	3.9	5.0	.....
Cultivating	32.8	17.7	63.6	25.8
Stripping	79.5	.....	66.7	.....
Hauling	43.2	15.71/	35.8	25.12/
Total	191.8	63.3	218.9	66.0

1/ Truck for hauling 11.5 hours more
2/ Truck for hauling 10.1 hours more

The cane is cultivated very intensively. An average of 192 hours of man labor and 219 hours of horse work per acre were used in growing and hauling an acre of the crop. The time required for land preparation and planting is greatest when a large part of the plot is planted and of course least when the cane is grown from the stubble. The labor of cultivation and hoeing varies with the condition of the soil, the season and the amount of hand work done. In some cases the labor of stripping was as much as one-half of the labor on the crop. The syrup obtained averaged 110 gallons per acre in 1927 and 129 gallons in 1928, with the yield in 1927 varying from 65 to 310 gallons per acre.

Miscellaneous Truck and Gardens

A few of the farmers grew truck crops for sale, and all reported gardens and truck crops for the use of the farm family. Some sales were made from the truck and gardens on nearly all of the farms and in a few cases the sales exceeded the labor and material cost expended. The quantity of the produce obtained was not estimated, but it was a very important contribution to the family living.

Truck crops, such as tomatoes, cabbage, string beans watermelons, canteloupes, potatoes and strawberries were grown for sale on a few farms, but with limited local markets and no system of reaching outside markets, the production of these crops is limited by the local demand and returns are uncertain. In 1927 some string beans were marketed outside the local area, but the returns were not such as to encourage the enterprise.

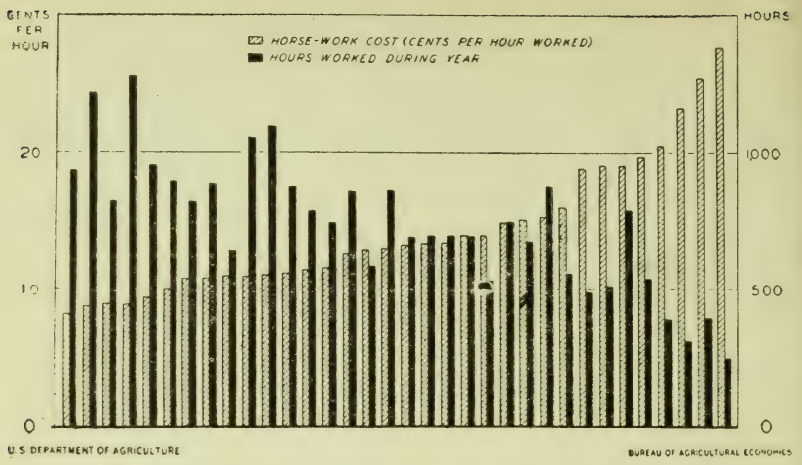

Figure X. Since horses consume some feed even when idle, good managers try to provide productive work for them throughout the greater part of the year. It is easy to see that as the hours of work per animal increased, the cost per hour's work decreased.

Work Stock

Although much of the field work on south Mississippi farms is done with one animal, still there is enough work such as hauling and land preparation for which two are used that this is the number kept on most of the farms. Those farmers who operate a part of the land with cropper labor must have work animals for the cropper employed. On some of the small farms only one animal is kept.

On the average there were 16 crop acres for each head of work stock but for the two years' records the crop acres varied per head from 7.5 acres to 28 acres on different farms. On some farms the acreage cultivated with one animal was as much as that cultivated by two head of work stock on others, but the number of crop acres does not indicate accurately the use made of work stock as some operators did outside hauling or other work off the farm with their teams.

Even with the small number of animals kept the cost of maintaining work stock is one of the heaviest items of expense of these farms. Table 19 shows the cost of keeping the work stock per head in 1927 and in 1928. Feed which was charged at current prices makes up three-fourths of the total and, including a charge for pasture on cultivated fields, averaged $70.90 in 1927 and $73.68 per head in 1928. The value of feed per head on one farm was as low as $46.10 and as high as $100.80 on another with the feed cost on other farms varying all the way between these extremes. "Other costs" include charges for man labor, interest on investment, taxes and cost for the replacement of animals. As the work stock was on pasture a small part of the year, the feed cost per head varied less than did the hours of work obtained from each animal. The relation of the number of hours worked and the cost for each hour of work is shown in figure X, and while in general the computed cost per hour is less on farms where

the horses were worked the most hours, there are numerous exceptions to the general rule. Stock which were kept up and fed grain whether they were worked or not show high costs of feed for the amount of work done. In 1928 the farm with the second highest feed cost worked the animals fewer hours than any other farm on the route. But on other farms where the grain feed was reduced or the animals put on pasture when they were idle the cost per hour of horse work is not high even though the animals may not have been worked a large part of the time.

Table 19.—Work Stock. Cost of Maintenance Per Head—Jones County, Mississippi

Year	Number of farms	Work stock per farm	Feed	Pasture	Other costs	Total	Work per head	Cost per hour of horse work
			Dollars	Dollars	Dollars	Dollars	Hours	Dollars
1927	19	2.8	68.88	2.02	24.85	95.75	649	.15
1928	15	2.5	70.40	3.28	19.10	92.78	767	.12

Table 20.—Work Stock. Feed and Labor Used Per Head—Jones County, Mississippi

Year	Farm	Grain fed per head				Mixed hay	Pasture	Man labor
		Corn	Oats	Other	Total			
		Bu	Bu	Lbs	Lbs	Tons	Days	Hours
1927	19	48.2	1.3	11	3551	.99	101	63
1928	15	46.0	9.5	92	3702	.94	135	64

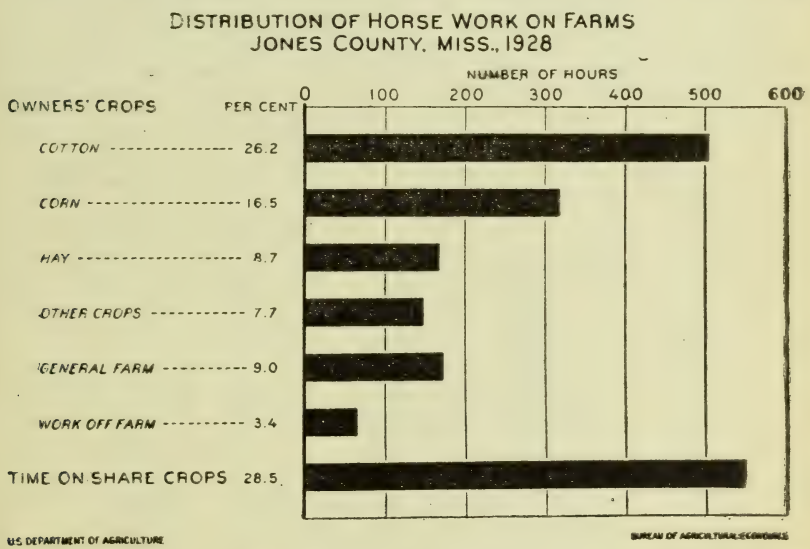

Figure XI. As with man labor, cotton consumes most of the horse work on crops. Most of the share crops of the section consisted of cotton. More crops on which horse work could be substituted for man labor should be found profitable if there was a market for such crops. Livestock is a possibility for providing such a market.

Feed for horses consisted almost entirely of corn and some kind of mixed hay. Table 20 shows the average amount of feed given per

head for the two years. In 1927 only three of the 19 farms fed any grain other than corn, the quantity of concentrates varying from 36 to 70 bushels per head and the roughage varying from .3 of a ton to 2.2 tons per head. The average amount of feed on the 15 farms in 1928 was practically the same as for the preceding year, but the variation in quantities fed on different farms was greater. A number of the farmers supplemented the corn with oats or mill feed, the total pounds of concentrates varying from 1712 to 5338 pounds and the quantity of hay varying from none to 2.2 tons per head.

Reduction in the cost of horse work may be effected in one of two ways: by more economical feeding or by adjusting the number of stock to the amount of work to be done. On some farms more liberal feeding of roughages would give an opportunity to reduce the grain feed when the animals were idle. Improved pastures for use of work stock when not working would also help to reduce the amount of feed given.

Few of the farms have more work stock than necessary, but few use their full horse power at any time except a short season of the year. Figure XI shows the proportion of horse work used on different crops in 1928. With most of the horse work on cotton or on share crops which are largely cotton it seems that an increase in crops using work at different seasons of the year would enable more nearly complete use of the time of work stock. Farms operated by one man usually have two head of work stock, but in cultivating with one-horse cultivators only one head can be used, without an additional hand. The use of two-horse implements if the man labor saved were used to in-

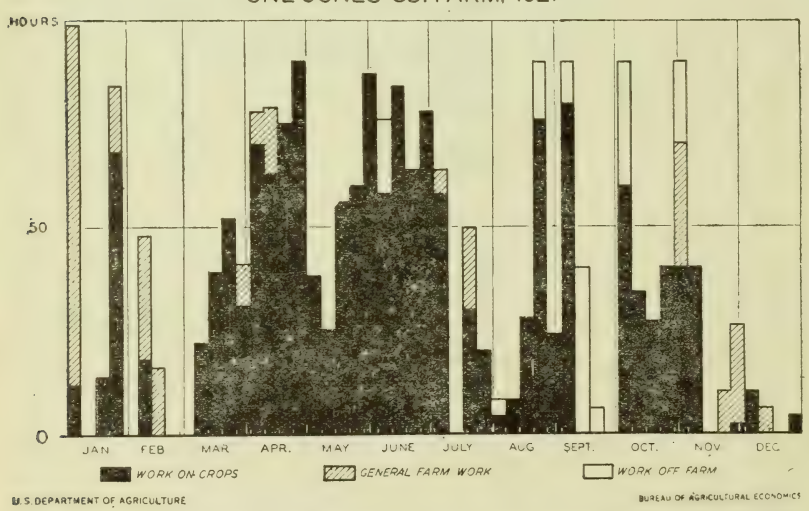

Figure XII. Although it is desirable to keep work animals profitably employed at all times, this is not always possible. There are sure to be idle days for work animals on even the best managed farms. With good pastures, all grain may be saved at such times, and part of the grain ration may be saved even with no pasture.

crease the acreage of crops would permit greater use of horse power and serve to reduce the cost of work per unit.

Figure XII shows the distribution of horse work by weeks on a farm with two horses and growing crops typical of farms in this section.

Milk Cows

The records of feed used per cow and production from dairy cattle do not represent present normal conditions for the area. The first year of the study the cows were on open range for 8 or 9 months of the year and although kept under fence in 1928 the pastures were undeveloped and no measure of the value of pasture is available. With few exceptions, cows were kept to produce milk and butter for home use only and they received little attention. Little interest is taken in breeding or feeding and although a few cooperators who took an interest in their herds realized substantial profits, yet the records cannot be used to indicate the possibilities for dairy production in the area. For the most part, the production per cow and the butterfat content of the milk was estimated.

In 1927 when the cows were on the woods range an average of two cows were kept per farm, the number ranging from 1 to 5. The production of butterfat on these farms varied from 75 to 225 pounds of butterfat per cow with an average of 107 pounds. Table 21 shows the quantity of feed used per head and the production obtained in the two years of the study. Cottonseed meal makes up the basis of the dairy ration, and on many farms cottonseed meal is the only concentrate fed. About one-half of the herds were fed some corn. As a general rule, little roughage is fed to cattle, the average quantity being only 520 pounds per head in 1927 and 360 in 1928. A few herds received no roughage at all and others were given a small amount of hay or cottonseed hulls.

Table 21.—Milk Cows: Feed Used Per Head—Jones County, Mississippi

		Concentrates per head					Roughage per head			
Year	Cows per farm	Cotton-seed meal	Cotton seed	Corn	Other	Total	Hay	Cotton-seed hulls	Total	Pasture 1/
		Lbs	Lbs	Lbs	Lbs	Lbs	Lbs	Lbs	Lbs	Days
1927	2.2	438	68	195	49	750	420	100	520	108
1928	2.1	355	39	166	92	652	220	140	360	346

1/ Pasture for 1927 is days on field following harvest. Animals were on open range the remainder of the time. Pasture for 1928 is days on fenced grass areas and fields.

With the enforcement of the fencing law and the eradication of the Texas fever tick, the improvement of dairying will be possible. With some care, dairying may become an important source of income on these farms and the records indicate the need for advancement along the following lines: improvement in stock, development of pastures and hay crops, and better feeding and herd management.

The stock now on the farms is small; mature cows weighing from 450 to 650 pounds. Good production will be attained by building up the quality of cows through the use of good sires and through feeding the growing heifers to attain their full growth. Native pastures do not provide the quantity or the necessary elements for a heavy milk flow and must be improved by introducing such pasture plants as carpet grass, bermuda and lespedeza. Some high grade roughage as soybean

or cowpea hay to supplement the pastures should be provided and this in turn supplemented with cover crops and intertilled crops for pasture. Wherever possible the addition of corn should improve the ration and allow a better use of the cottonseed meal and roughages. The feed requirements for production suggested in Mississippi Station Bulletin 259 will be applicable to this section as well as to the Short Leaf Pine sections of the State.

The present lack of marketing facilities will hinder the development of the dairy enterprise and for most farmers in the county the distance to Laurel is too great to justify the hauling of cream from a few cows. Until nearer stations are established a plan whereby a number of farmers may haul the cream by turns for the neighborhood offers one solution of the marketing problem. A plan of marketing cream would work well with a similar plan for marketing the surplus of family gardens or small areas of truck.

Poultry

Poultry like dairy cows are kept primarily for home use and the production of the flocks as shown by these records is largely an estimate. There were enough instances of successful poultry flocks, however, to show that this enterprise could be a profitable one on these farms when expanded to provide a surplus of eggs and poultry for sale. The size of the farm flocks varied from 15 to 137 hens in 1927 and from 20 to 125 in 1928. The averages for the respective years being 53 and 55 hens. Only one flock in 1927 had more than 100 hens whereas 3 of the 15 flocks were larger than 100 hens in 1928.

There is as wide a variation in the amount of feed and care given as there is in the size of the flock and on most farms no particular effort was made to obtain high production. The quantity of feed used on the average and the production obtained for the two years are given in table 22. More grain was reported fed in 1927, yet the production was less than in the following year. The amount of feed used per head was greater on those farms with a large production of meat than on those where eggs were the most important product. Of the three larger flocks in 1928, one produced 50 eggs and 7.4 pounds of meat per head, a second produced 54 eggs and 9.0 pounds of meat per head, and the third produced 128 eggs and only 1.28 pounds of meat per head. One farm producing meat and the one farm producing eggs showed a greater profit per hen above feed and labor cost than other flocks on the route. Those three flocks were easily the most profitable for although a few small flocks showed more profit per hen than one of the three, yet the total net returns were less than those from the larger flocks. Each of these three flocks was given more mill feed than the other flocks and two were fed more grain than were any others.

Table 22.—POULTRY: Feed and Labor Used Per Head and Production Obtained Jones County, Mississippi

Year	Number of farms	Poultry per farm	Production per head		Feed per head			Man labor per head
			Eggs	Meat	Corn & other grain	Mill feeds	Total	
		Number	Number	Pounds	Pounds	Pounds	Pounds	Hours
1927	19	53	49	3.8	33	11	44	1.1
1928	15	55	66	3.9	24	5	29	1.3

The income from poultry on most of the farms could have been increased through an improvement in stock and better feeding and handling practices. The flocks on the route received some skimmilk, kitchen refuse and vegetables not included in the table and where a flock of 100 or more hens is kept it would be desirable to have skimmilk to supply the necessary animal protein. A small increase in the number of cows and an increase in poultry to make use of skimmilk would help greatly in providing a balanced business on these farms.

Table 23.—HOGS: Feed and Labor Used Per 100 Pounds of Dressed Pork
Jones County, Mississippi

Year	Farms	Dressed pork per farm	Feed used			Value of feed	1/ Value of pasture	Man labor	Cost of 100 lbs. dressed pork
			Ear corn	Other feed	Total				
		Lbs	Lbs	Lbs	Lbs	Dollars	Dollars	Hours	Dollars
1927	17	704	608	56	664	9.13	.61	15	12.05
1928	15	581	641	249	890	12.51	1.13	13	15.73

1/ Open range and fields in 1927. Fenced enclosures and fields in 1928.

Pork

The recent changes in the fencing law have forced changes in methods of pork production so that, like the records of dairying, those of pork production were not obtained under conditions which make the results applicable to present farming systems. But like the other livestock enterprises hogs are grown primarily for family use. The hogs in 1927 were produced on the open range, and although the hogs in 1928 were produced under fence the type of hogs was the same in most cases as that of the preceding year and the records emphasize the need for an improvement in the quality of hogs if pork production is to be profitable.

In table 23 is shown the average production of pork and the quantity of feed used for each hundred weight of pork for the two years. In 1927 two of the farms on which records were kept had no hogs, and no farm in either year produced more than 2000 pounds of pork. Although one farm produced only 100 pounds of pork from 104 bushels of corn due to a cholera outbreak, the average amount of corn for each 100 pounds of pork was less in 1927 than in 1928. The amount of feed required varied widely on different farms ranging from less than 300 pounds to more than 1400 pounds for each 100 pounds of dressed pork in each year.

The range bred hogs will have to be replaced with a type that will make more gains for the feed consumed, and some protein supplement should be added to the corn ration before economical gains can be expected. With improved pastures for hogs, skimmilk where it is available, and sanitary measures for preventing worm infestation and disease, the hog enterprise as a source of meat for the family will have a place in the farm organization and under favorable conditions a small surplus may be produced at a profit.

Systems of Farming in Jones County, Mississippi

This study of the farm records in Jones County, Mississippi, for 1927 and 1928 discloses some of the weaknesses of the present system of farming that are most common, and shows some methods that were more successful than those followed on the greater number of farms.

In 1927 when the cotton yields were exceptionally high and good prices were received for cotton, most of the farmers received a greater net income than can normally be expected in this area with present farming methods. The next year, however, with the low yield of cotton, few of the farms returned more than a low rate for the labor that was used on them. As low yields of cotton must be expected in some years, some other sources of income on the farms is highly desirable. It is the purpose of this section of the bulletin to show how some of the weaknesses of the farming system may be corrected through suggestions brought out in this study and through the results of other Experiment Station research.

In developing a plan for the operation of a farm in this section of Mississippi, a number of facts must be considered. Of these one of the most important is that many of the farms as operated are too small to give high returns to the farm operator, and that unless the farm earnings are supplemented by income from outside the farm business, a low personal income must be expected. Too often the size of the farm business is limited by the acreage of cotton that can be cared for. With the yields that are normally expected and with usual or average prices the income from 8 to 12 acres of cotton will not permit a very high standard of living, even with a large part of the family living coming from the produce of the farm.

In this section few of the farms can materially increase the acreage of cotton grown per man even with the most efficient practices. The uneven topography and the necessary terraces which break the land into small irregular fields limit the extent to which man power can be replaced by horse or machine work and even on the level fields, which are free of stumps and where two-horse implements can be used, the hand labor necessary for picking the crop will still limit the acreage grown.

Farm practices, with the possible exception of those on cotton, are not standardized nor has the value of many of the possible supplementary crops been determined. The profitable production of many of the truck crops that grow well in the area is limited by the lack of an organized market, and few of these crops can be included as a permanent part of the farm business. There is, however, a limited place for truck crops on some farms and this, with livestock production and the inclusion of feed crops, offers the means of increasing the size of the farm business. Like the truck crops an extensive development of the livestock enterprises is also dependent upon the development of markets.

Fully as important as the problem of increasing the size of the business is that of increasing the crop yields and the livestock production. The low crop yields can in a measure be corrected with a more liberal use of fertilizer or by developing a cropping system which includes cover crops and legumes.

A more efficient use of horse work could be made on many of the farms. The crops grown on the typical family farm are not sufficient to keep a team of work animals busy, but with a larger acreage of crops, the same investment in work stock and only slightly higher feed costs, the amount of work done by horses could be increased materially.

These are practical problems in the area, and are factors which tend to keep the farm earnings at a low figure. Some of these problems will continue to be handicaps on a number of the farms and are the natural disadvantages to farming in the area. Others can, in a measure, be corrected on some of the farms. Below are listed some of the things which should be kept in mind by operators who are planning a program for an improvement in the operation of their farms.

1. Improvement in the farm layout
2. Increase in the number of crop acres handled
3. Inclusion of cover crops in the farm system
4. Production of feed crops
5. Production of marketable truck crops
6. Improvement of pastures
7. Increase in number of livestock
8. Improvement in the quality of the livestock

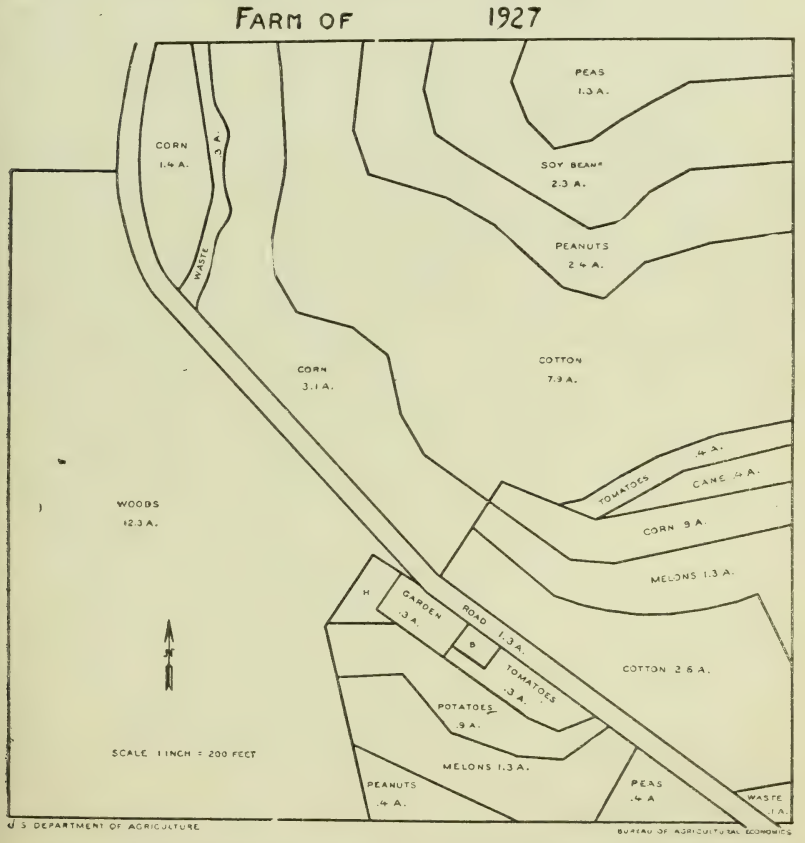

Figure XIII. The large number of small fields are poorly adapted to large power units and labor saving machinery. The fields are divided by terraces. The operator of this small farm did quite well with truck crops adaptable to small fields, but the market is too limited for many farmers of the community to succeed with truck crops.

Attention along all of these suggested lines is not necessary on all of the farms. On some farms steps have already been taken along the lines suggested; and while it will not be possible to show how many of the farms in the area can be improved through changes in the organization of the farm business, a few examples will be given from farms on which records were obtained and the method of estimating the results from contemplated changes will be shown.

Organization of Small Farms

One of the small farms as it was operated in 1927 illustrates a number of the points brought out in the preceding discussion. This farm with 27 acres in crops and 14 acres in woodland and waste was one of the most profitable farms on the route in 1927, with cash receipts amounting to about $1800.00 including $622.00 received from outside sources other than farm sales. The value of the sales from the farm was about equal to the average for the route.

Figure XIII shows the farm layout for 1927. The land is rolling and the field boundaries follow the terraces. The soil is somewhat better than some of the soil in the county, as about half of the farm is Orangeburg Sandy Loam, which is considered one of the most productive soils of the county. In 1927 this farm had 10.5 acres of truck crops including 2.8 acres of peanuts. In addition to the cotton crop which, with better than the average yield for the farms, amounted to $700.00, the sale of tomatoes and melons amounted to nearly $250.00, syrup and seed cane to $75.00 and potatoes $37.50. This only illustrates the increase in the earnings that may come from the sale of truck. Other crops such as string beans, turnips, strawberries, and sweet or Irish potatoes might have been grown. These crops were grown on some of the farms during the two years of the study. As an insurance against the loss of a crop or against an unsatisfactory market for all of the truck, it may be advisable to grow a larger variety of crops, and a smaller acreage of each. This would tend to distribute the labor over a longer period of time.

Unfortunately this system cannot be used on all farms. For the crops that depend on a local market the acreage that can be sold profitably is very limited, and means of marketing may not be available to all producers.

This farm did not produce livestock or livestock products except for the use of the farm family, and it is doubtful if the inclusion of livestock would have been as profitable as were the truck crops. Perhaps some livestock could have been added, but with the available land so limited the growing of feed crops would have meant a decrease in the acreage of cash crops. Temporary pastures on any part of the crop land would have required the erection of temporary fences and the field arrangement which is largely determined by the slope of the land does not lend itself readily to temporary pasturing on a part of the acreage. This farm is not divided into as many small or irregular fields as are most of the farms on which records were obtained.

If livestock above the needs of the farm family were included in the organization, some pasture would need to be developed. The improvement of the woods pasture would help some, but a more practical way would be to acquire and develop a larger farm.

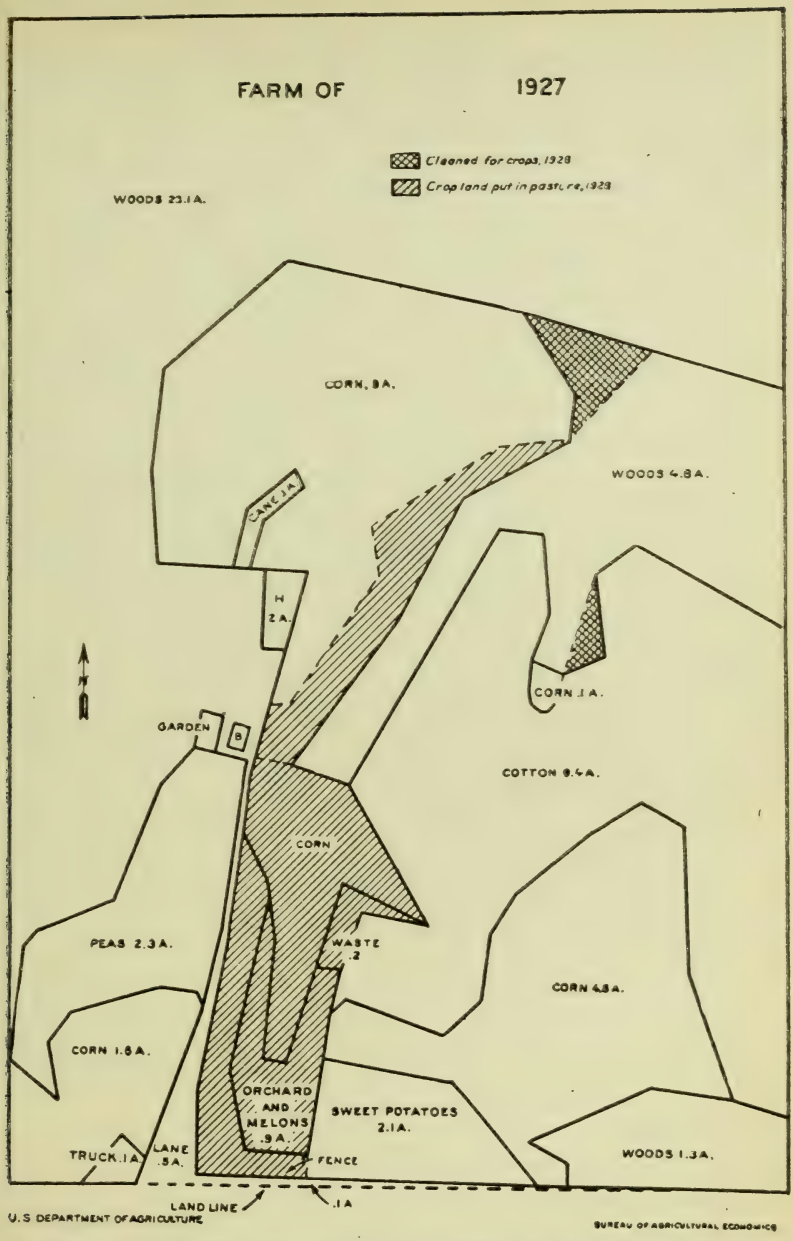

Figure XIV. This farm had somewhat larger fields than that shown in Figure XIII, but they are still too small and irregular for larger than two-horse machinery. Farming such land to general field crops can never be very profitable. Converting it to improved pasture and grazing livestock offers possibilities for a more economic use.

Farm "B" which is outlined in figure XIV is more nearly representative of the farms in the section in that the acreage and the kind of crops grown are more nearly the same as those found on a majority of the farms. This farm being somewhat larger offers a better chance for the development of supplementary enterprises other than truck crops. This with a slightly larger total investment than farm "A" had somewhat lower crop yields and much lower farm expenses. The farm used less fertilizer on the crops and was more nearly self-sufficing. Farm sales totaled $753.00 of which $564.00 was from the sale of cotton and cotton seed. This farm had 11 acres of cotton, 13.6 acres of corn, 2.3 acres of hay and 2.1 acres of sweet potatoes. Cash expenses on this farm were low, but a larger outlay for more fertilizer on cotton and corn would probably have increased the earnings of the farm. Higher yields would be one thing to work for on this farm.

Very few livestock products were sold from this farm although 50 head of poultry and three cows were kept. No truck crops were sold, but some income was made from labor off the farm. As indicated in the diagram of the farm an effort was being made to develop some pasture for livestock and to straighten some of the irregularities in the field system. An idea of the prospective income from the farm with the organization changed to increase the pasture for cattle, to improve the quality of stock, and to increase the yields of the crops may be obtained from the comparisons given in tables 24 to 26.

Table 24 shows the organization of farms "A" and "B" with the suggested organization "C" added. The 40 acre farm is too small to include the minimum acreage of cash crops and to provide for a suitable acreage of pasture, although even on the small farm the livestock suggested could be included if all of the woodland were converted to improved pasture. However, the poultry enterprise could be included on the smaller farm with little change in the farm set-up.

The changes on the second farm which would be necessary to put the suggested plan in operation are small and would not affect the labor distribution of the farm to a great extent. Somewhat more labor would be required for the truck crops on farm "A" than for the crops added to the suggested system. In order to compare the merits of the different systems of farming, the efficiency of production in each should be put on a comparable base and similar prices used. Unfortunately, prices on the truck crops are not sufficiently stable to justify an estimate of changes that might take place in a series of years, and we must assume that the value of the truck crops will be approximately the same even with changes in the value or in kind of crops grown.

As yields in 1927 were above normal the cotton yield assumed in making a comparison of the farming systems is less than those obtained in 1927, but above the yields of 1928.

Table 24.—Systems of Farming in Jones County

	Farm "A" Cotton and truck as operated	Farm "B" Cotton as operated	Farm "C" Cotton and livestock (suggested)
Size of farm—acres	41	60	60
Crops —acres	27	29	30
Woods and waste—acres	14	31	20
Pasture—acres			10
Crops Grown			
Cotton—acres	10.5	11.0	10.0
Corn—acres	5.4	13 6	10.0
Hay—acres	4.0	2.3	5.0
Truck crops—acres	7.1	2.1	5.0
Out pasture—acres			10.0
Livestock			
Horses—Number	2	2	2
Cows—number	1	3	4
Poultry—number	15	50	150
Pork produced—pounds	100	150	1000

Table 25 shows, first, the production of crops and livestock on these two farms as reported for 1927 and secondly the production that could be expected as an average over a long period of years with approximately the same efficiency in production on each farm. The adjusted or normal yields are such as could be expected on most farms in the county and the better farms could undoubtedly exceed these yields or obtain the same yield with less expenditure of fertilizer.

For cotton the yield is slightly below the yields obtained in 1927; but considering the yields since 1919, as shown in Figure 6, 300 pounds of lint cotton could hardly be depended on even with the application of approximately 500 pounds per acre of a 4-8-4 fertilizer. The normal yield of 250 pounds should be a conservative estimate of production. Corn production has been adjusted for a yield of 25 bushels per acre, with about 100 pounds each of nitrate of soda and superphosphate applied. In 1927 farm "A" obtained a yield of 28 bushels and farm "B" a yield of 22 bushels with no fertilizer. While 1927 was not a year of exceptional corn yields, some allowance is made in the normal figure of 25 bushels for the effect of cow peas or velvet beans on the acre yield. The cost of planting the corn to beans or peas has been made in the expenses on the adjusted system.

Hay yields estimated at 1.5 tons per acre should be obtained from soybeans or cow peas planted on land heavily fertilized the preceding year. No change in the estimated value of truck crops on farm "A" was made. With good yields and prices for potatoes, a higher income might be obtained or allowance made for low earnings of other truck crops.

Table 25.—Production Under Different Systems as Reported for 1927 and as Adjusted for Normal Yields

	Farm "A"		Farm "B"		Farm "C"
	1927	adjusted	1927	adjusted	adjusted
Cotton—bales	6.3	5.25	5.76	5.5	5
Cotton seed—tons	3.15	2.62	2.88	2.75	2.5
Hay—tons	5.2	6	2.5	3.45	7.5
Truck	$356.00	$350.00			
Corn—bushels	150	135	295	340	250
Butterfat—pounds	89	150	346	450	600
		1 calf		3 calves	4 calves
Poultry					
Meat—pounds	50	75	150	250	750
Eggs—dozen	15	112	250	375	1125
Pork—pounds	78	1200	1493	1550	1200

Livestock production is adjusted to a scale slightly higher than the average of the farms, but in doing this, feed to make up a balanced ration has been included in expenses and a more liberal allowance of feed to poultry charged to the adjusted systems. Here, as with the crops, the "normal" production was exceeded on some farms. For the most part, the feed allowance for production was taken from Mississippi Station Bulletin 257. The production of butterfat is adjusted to 150 pounds per cow or approximately 350 gallons of 5 per cent milk. With a ration of corn and cottonseed meal, soybean or cowpea hay, and some improvement in pastures a production of 150 to 200 pounds of butterfat should be obtained from the stock on the farms. In 1927 the production of fat on farm "B" was estimated at 127 pounds with the cows on scant pasture and receiving a limited supply of corn and hay, but no cottonseed meal.

Surplus vegetables and truck crops are commonly fed to hogs and these with 500 to 600 pounds of grain, where some pasture is available, should be sufficient to produce 100 pounds of pork. The stock of hogs on these farms should be improved and hogs suited to pen and pasture feeding should replace the range stock so common in the area. For poultry, an allowance of 40 to 50 pounds of grain per head with 15 to 20 pounds of mash fed to improved, carefully culled and handled stock, should produce 7.5 dozen eggs and 5 pounds of meat per hen.

The cost of cottonseed meal, bran, and other mill feeds is included in the expenses on the different farms as adjusted in order to make the results comparable.

Table 26—Income and Expenses for Different Systems in 1927 and as Estimated for Normal Yields and Prices

	Farm "A"		Farm "B"		
	1927	adjusted	1927	adjusted	Farm "C"
	dollars	dollars	dollars	dollars	dollars
Income from farm products					
Field crops	731	615	692	703	518
Truck crops	336	350			
Livestock	85	116	61	301	647
Total	1172	1079	753	1004	1165
Farm expenses	692	478	283	543	527
Difference in farm receipts and expenses	480	601	470	461	638
Excess furnished home	820	285	185	285	285
Excess of outside earnings over hired labor	445	100	102	100	100
Earnings of operator and farm	1245	991	757	846	1023

Table 26 shows the income and expenses on the farms as operated in 1927 and adjusted to normal prices and production. The price of cotton was taken at 17½ cents per pound and cottonseed at $32.00 per ton. The final figures for earnings of operator and farm show two or three important comparisons. Farm "A" with no family labor obtained a large share of the income from work outside the farm. This income is balanced in part by the expenses and as the opportunity to do outside work is not open to all operators, this has been reduced in the adjusted system to correspond with the outside earnings on other farms. At best, the earnings from work off the farm are undepend-

able and should not be considered in comparing the earnings from different farming systems.

Farm "B" growing little for sale except cotton, had lower earnings than farm "A". Including more fertilizer and more feed to livestock almost doubled the expenses in the suggested system, but with a good chance of materially increasing the farm profits. Most of the increased earnings on this adjusted farm result from the higher livestock production assumed.

The suggested organization "C" with more livestock than on "B" but with no more truck crops indicates an earning power similar to that on "A" with an equal opportunity for outside work.

These comparisons are suggestive only, but indicate some opportunity for increasing farm earnings, either by adding some productive livestock or truck crops to the corn and cotton organization or by increasing productive efficiency on the farms. Operators may be well repaid by thinking through the estimated expenses and prospective returns from enterprises that are possible additions to their own farm in a manner similar to that just given here. For those who are interested in the method of budgeting farm resources and estimating returns before making a change in their present systems, Mississippi Agricultural Experiment Station Bulletin 257 describes the method followed and provides the necessary forms for working out a farm budget.

Plans for the Organization of Larger Farms and Possibilities for the Area

The preceding discusison has been devoted to farms operated by one man, but applies to the larger farms as well. As organized, the farms with a larger acreage would typically consist of the land operated by the owner and additional farm land operated by share croppers. The outlook for expansion in this direction is not optimistic since it seems necessary to increase the production per man in order to keep pace with communities which have made more progress in the use of power and machinery. The following discussion is based largely on the results obtained by the Animal Husbandry and Agronomy Departments of the Experiment Station as applied to the natural and economic conditions of the Longleaf Pine section. Similar results have been and are being obtained on individual farms in the area. The suggestions are offered for those who have the means and the inclination to obtain more than a comfortable living from agricultural pursuits in the area. A list of station bulletins consulted is appended to this discussion.

Potential agricultural land is plentiful and relatively cheap while the climate is ideal for a great variety of crop and livestock enterprises. Transportation facilities are good. On the other hand, it may be frankly stated that the greater part of the land in its natural state is too poor for ecenomical production without the liberal use of fertilizers and that the capital and labor necessary to bring the land into production constitutes a problem. Markets for practically all commodities other than cotton are yet undeveloped and the cattle tick is still a menace to much of the area.

These handicaps may be overcome and machinery for removing

some of them is already in motion. The land responds readily to and will return a satisfactory profit on the use of commercial fertilizers, while a number of legume crops are sufficiently well adapted to the area to be used for soil improvement. A large number of farmers of the section have had their stumps removed by Wood Distillation companies for the stumps, and it might be assumed that where car lots of stumps can be assembled, either individually or cooperatively, the value of the stumps would approximately offset the cost of clearing. Markets will be established or may be obtained as production attains the volume and uniformity necessary to justify them, while the doom of the cattle tick is written in the fencing laws and the dipping program now in force. Farmers are now being excused from dipping as their pasture becomes tick free, and in the course of time, quarantine restrictions on the movement of livestock will be lifted.

In view of these conditions, one who contemplates the undertaking of extensive agricultural operations in the area should be possessed of a pioneering spirit and sufficient capital or credit to operate until the undertaking reaches a paying basis. Few industries are expected to pay dividends the first year and developing a farm in a comparatively new farming section should be no exception. At least three years should be allowed for establishment of the undertaking and development of markets, and management programs may well be based on ten year periods.

Figure XV. Where land is plentiful, the tendency is to abandon eroded spots as shown in the central part of this view, thus permitting fields to become more and more irregular in shape. Comparatively large and regularly shaped fields are necessary for the successful operation of large machinery.

Specialized Cotton Farming

In the midst of the general call for more diversification, a plan for a specialized cotton farm may seem strange. However, it is assumed that where one lives on the land, the farm will supply the home

with such products as are adapted to the area and necessary for a reasonable standard of living. The following plan is suggested for those who may make their home in town or who may follow some occupation other than farming for a part of the year.

For this type of farming, the land should be carefully chosen in regard to terrain and location. Land which is not adapted to the use of mechanical power would perhaps not be profitable when put to this use. This calls for large fields, free from stumps and unobstructed by ditches and terraces which cannot be readily crossed by a tractor and its equipment. Slightly rolling land where extremely broad base terraces will suffice may be used, in which case, planting and cultivation would be extended across the terraces without regard to the slope of the land.

In regard to location, it should be remembered that annual rainfall increases as one approaches the Gulf and that weevil damage is closely associated with annual, and especially seasonal rainfall. Such a type of farming would, therefore, have a better chance for success in the northern than in the southern part of the Longleaf Pine section. The following estimates are based on data of the South Mississippi Experiment Station, Poplarville, the experience of tractor users in various parts of Mississippi, and prices as estimated by the U. S. Department of Agriculture for Mississippi. They are offered as suggestions, and to show a method of estimating probable results. They may be changed to meet varying conditions. The unit is 100 acres of cotton.

Equipment suggested for the handling of this acreage, together with its approximate purchase price is as follows

2 tractors with accompanying equipment @ $1400.00	$2800.00
1 truck, $1000.00 and 1 trailer, $300.00	1300.00
1 ditcher	125.00
1 six-ft. grain drill	135.00
2 mules @ $150.00	300.00
Miscellaneous: wagon, harness, hoes, bags, etc.	240.00
Total	$4900.00

It is estimated that where the tractors would be used for one plowing, two diskings, one bedding, one planting, and four cultivations on the cotton crop and two diskings and one drilling on a cover crop, the total tractor use would amount to 70 days each per year. Some of these operations would be combined as one disking and drilling the cover crop. The truck would be used for practically all hauling and its total use would depend largely on the distance from gin and market. The use of other equipment would vary with circumstances.

Where the land and improvements are valued at $40.00 per acre, and it is assumed that one man capable of operating a tractor is hired for a period of six months, and that all hoe work and picking is hired, the approximate costs per acre for estimated yields of 250, 300 and 350 pounds of lint are given in table 27.

Table 27.—Estimated Expense Per Acre on Cotton on a Large Specialized Cotton Farm

Estimated yields of	250 lbs lint	300 lbs lint	350 lbs lint
Interest on real estate—5% on $40 per acre	$2.00	$2.00	$2.00
Interest on equipment—6% on $49 per acre	2.94	2.94	2.94
Depreciation on equipment—14% on $49 per acre	6.86	6.86	6.86
Wages and upkeep, 1 man 6 months @ $100 per mo.	6.00	6.00	6.00
Wages, hoe hands, contract, twice over	3.00	3.00	3.00
Wages, pick contract, $1.50 per cwt.	11.25	13.50	15.75
Gin and wrap, 1 cent per lb lint	2.50	3.00	3.50
Fertilizer—600 pounds 4-8-4	8.50	8.50	8.50
Seed—1.75 bu. @ 80 cents	1.40	1.40	1.40
Kerosene, gasoline, oil and grease	5.42	5.78	6.12
Mule feed	2.00	2.00	2.00
Taxes—40 mills on 3-4 valuation after exempting $500 for ditcher, drill and miscellaneous equipment	2.51	2.51	2.51
Totals	$54.38	$57.49	$60.58

The lowest yield considered is considerably higher than the average yield for the state, but the amount of fertilizer allowed is nearly three times the average used per acre in the state. The average yield of cotton so fertilized at the Poplarville station for the 4 years 1925 in 1928 was 384 pounds lint cotton per acre, assuming that lint was equal to one-third of the seed cotton.

Interest charges are based on the assumption of owned land and capital. Where capital is borrowed, the rates paid should, of course, be substituted.

Depreciation on equipment might vary considerably. With careful handling, it might be less than the estimate or, with rougher use and more of it, it might be more.

It is assumed that the owner will operate one tractor. A son might operate the other or two sons might operate both. However the hiring of one tractor operator for six months is used in the account. Since the tractors are only operated on cotton 70 days each, this man could also operate the truck. Hoeing is based on twice over at $1.50 per acre. Hoe labor should be reduced to the minimum and there are a number of possible ways which have been suggested, but not fully tried out. Of these, checkrowing with cross cultivation and pasturing with geese may be mentioned. Picking is by contract. One should look carefully into the possible labor supply where this amount of hired labor is to be used.

It should be possible to reduce the cost of fertilizer after a few years without reducing the yield, if the practice of sowing a cover crop containing a legume each fall and plowing it under in the spring, were carefully followed. No cost item has been allowed for cover crop seed as this should be offset by fertility and some pasture of feed value. It is assumed that new seed are purchased each year.

Table 28.—Estimated Gross Return on Cotton for Varying Yields and Prices

Yield per acre	250 lb lint 500 lb seed	300 lb lint 600 lb seed	350 lb lint 700 lb seed
Prices as estimated			
Lint at 20 cents per pound	$50.00	$60.00	$70.00
Seed at $33.90 per ton	8.47	10.17	11.86
Totals	$58.47	$70.17	$81.86
1923 prices			
Lint at 32.5 cents per pound	$81.25	$97.50	$113.75
Seed at $49.30 per ton	12.32	14.79	17.25
Totals	$93.57	$112.29	$131.00
1926 prices			
Lint at 11.6 cents per pound	$29.00	$34.80	$40.60
Seed at $21.00 per ton	5.25	6.30	7.35
Totals	$34.25	$41.10	$47.95
1928 prices			
Lint at 18.5 cents per pound	$46.25	$55.50	$64.75
Seed at $39.00 per ton	9.75	11.70	13.65
Totals	$56.00	$67.20	$78.40

Kerosene was valued at 12 cents per gallon, gasoline at 22 cents, oil at 50 cents per gallon and grease at 20 cents per pound. The requirements were estimated and would vary with type of soil, distance of haul, type of machine and other factors.

It is assumed that the larger part of the mule feed is purchased, although enough might be raised without detracting from the efficiency of cotton production.

Taxes would of course, vary with the locality.

The average estimated December 1 farm price of cotton lint in Mississippi for the eight years 1921-1928 is 20.9 cents. The average estimated price received by farmers in Mississippi on November 15 of the same years is 19.9 cents. The average estimated December 1 farm price of cotton seed for the period is $33.90 per ton.

Using the approximate average of the two estimated lint prices and the estimated price of seed, an estimate of the probable returns from the enterprise may be made. Some additional prices will be used for comparison.

These various estimates of probable returns emphasize the advisability of maintaining a liquid reserve fund to care for unfavorable years.

Since the operation of this business would occupy the operator for only a part of the year, it might be combined with one or more of the following enterprises or with custom work wherein a more efficient and economical use could be made of the power equipment.

Fruits, Nuts and Truck Crops

A wide variety of fruit, nut and truck crops can be satisfactorily produced in the Longleaf Pine section of Mississippi. Of the tree crops, certain varieties of peaches, pears, pecans and, in the southern part, satsuma oranges have been successfully grown. Grapes, both bunching varieties and muscadines, do well. Strawberries, tomatoes, sweet potatoes, early Irish potatoes, cabbage and related crops, cucumbers, string beans, butter beans, English peas, turnips, rutabagas and onions constitute other crops for which the area is quite well adapted under reasonably good management.

With the exception of satsuma oranges which are subject to a climatic hazard, the outstanding drawback to the trucking industry is the absence of satisfactory markets. A lesser drawback is the necessity of constantly combatting insect and fungus pests. Since the latter may be controlled by proper spraying and dusting, it may be dismissed and the discussion confined to organization and marketing.

Tree crops require several years of attention before coming into bearing. This time, under good management, ranges from about three years after setting for satsuma oranges to eight or ten years for pecans with peaches requiring a little longer time than oranges. Small fruits and vegetables are annuals and crops may be expected as soon as the soil is in a good state of tilth. Few cost figures are available, but in 1921, a study in the Copiah County trucking area showed the following gross costs per acre: Tomatoes $210, Cabbage $137, Peas $161, Beans $103, and Carrots $124. In 1925, a survey in South Mississippi showed the following cash expenses per acre: on cabbage $120, on early Irish potatoes $110, on cucumbers $10, on tomatoes $60, on sweet potatoes $5, on strawberries $100 (estimated and including labor), and on sugar cane $55. With the exception of strawberries, these costs did not include charges for man labor, horse work or land and machinery use. Seed, fertilizer, packages and such hired labor as syrup making constituted the principal items included. In most cases, these crops were produced profitably when marketed locally, but when shipments to outside markets were undertaken, the marketing problem at once became acute.

Several possible solutions of this problem may be suggested, but it must be borne in mind that when any area seeks outside markets that it will meet keen competition from well established areas as well as other new areas possessed of similar ambitions, and that offerings of a constant supply in quantity of uniform and high quality products over a period of several years may be necessary to establish marketing connections on a paying basis.

These conditions can best be attained by the cooperation of a number of serious minded growers who are willing to sacrifice some individual ideas for the benefit of the undertaking and who can afford, and are willing, to content themselves with little or no profit until the industry shall become established. Such an organization should agree on varieties to plant, time to plant and method of marketing. Car lot shipments may be made, or buyers from outside markets may be attracted to the area. With an adequate supply of high quality products, processing plants may be established, or with such products as sweet potatoes and syrup a cooperative processing plant may be built. Growers should be reminded, however, that a processed product is not yet sold and marketing may still remain a problem. This is especially true of canned products where the retail trade is accustomed to established brands. For this type of processing, it is perhaps better to interest processors who already have established marketing channels to locate factories in the area than to attempt their establishment wholly with local capital and enterprise. Growers should especially be warned against canning equipment salesmen who offer to assist in organizing local companies or cooperatives in order to make a sale of equipment. Such undertakings are often permature

and failure results from an insufficient supply of raw products or the difficulty of disposing of the finished goods. Before such a step is undertaken, some competent authority should be consulted.

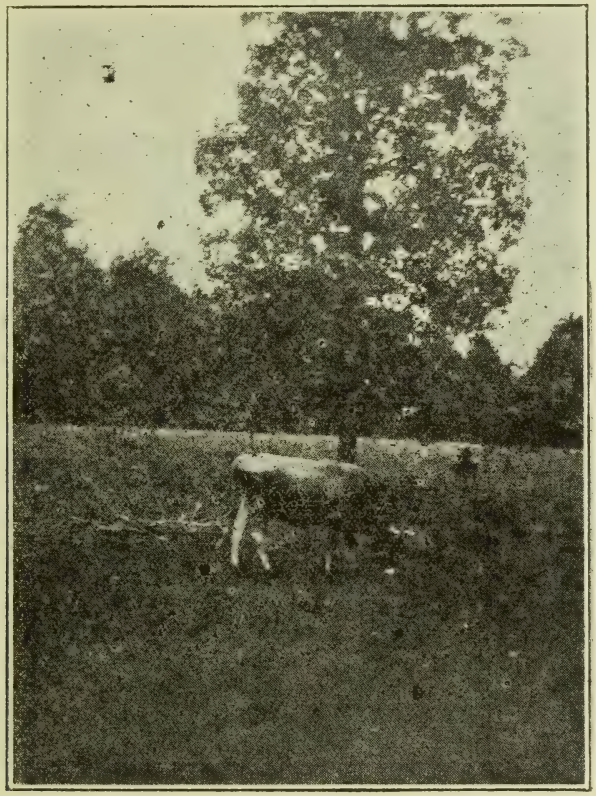

Figure XVI. This small pasture with perhaps one-third of the area in woods provided ample grazing for one animal unit per acre for a period of seven months. The grazing consisted principally of carpet grass and lespedeza—natural seeding. A few goats kept the area free from weeds and brush.

Livestock

With the abundance of cheap land and the prospects of finally exterminating the cattle tick, South Mississippi offers excellent opportunities for grazing types of livestock enterprises. For such an undertaking, the primary step is the development of pastures.

A pasture, to be profitable, must be something more than a tract of land under fence. A fence is necessary, of course, but the number and variety of grazing plants within the fenced area is even more important.

The cost of constructing fences varies considerably, depending on the kind and cost of materials, the outline of the area to be fenced

and the terrain. These costs would have to be calculated for each undertaking. Materials for fencing, with posts valued at 15 cents each and placed ten feet apart, will cost per rod about as follows: for five strands barbed wire, 50 cents; for 35 inch woven wire and two strands barbed wire 80 cents; and for 52 inch woven wire 90 cents. The length of fence can be calculated and the labor charge estimated to obtain the approximate cost of fencing.

Pasture land should be cleared of stumps to faciliate the operation of mowing weeds and keeping down brush. Plowing is advisable after which a pasture mixture in which bermuda grass, carpet grass, paspalum and lespedeza predominate, should be sown. A liberal application of fertilizer on the pasture is a good investment. Heavy grazing should be avoided until the grasses are well established and overgrazing should be avoided at all times. A rotation of pastures greatly increases the total carrying capacity and adds to the pasture values.

Beef Cattle

An advantage in the production of beef cattle lies in the fact that they can be marketed at distant points. The transportation charges and approximate shrinkage are not difficult to calculate. When the quarantine is lifted from the area, producers will have a choice of local markets, St. Louis or New Orleans. Either milk fat calves, grazing steers or feeder steers may be produced and from present information, it appears that the demand will be good for several years at least.

The important points to observe in addition to the maintenance of adequate pastures are the use of a pure bred bull of a beef breed, and liberal provision for wintering the breeding herd. Native cows may be used in starting, but these should gradually be replaced by heifers selected for beef type and quality. Fall sown oats may be relied upon to reduce the feed cost of wintering. As the area is ordinarily on a deficit feed basis, it is doubtful if carrying more animals than the breeding herd through the winter would be profitable. About one ton of hay and 180 pounds of cottonseed meal per 1000 pounds of live animal is a liberal winter feed allowance. Although pastures have been developed in the area to carry one mature animal to two acres, one animal to three acres is considered good pasture, and one to four acres would be a safer basis of estimate.

Sheep and Goats

Where fences are adequate, sheep and goats may be pastured with cattle with profitable results. Sheep, where efficiently managed, have returned handsome profits to their owners. On the other hand, inefficiency in handling may very quickly result in loss.

Dogs and internal parasites constitute the chief hazards of sheep production in the area. The first may be overcome by pasturing the flock within sight of the house and confining the sheep in a dog proof lot at night. The second has been largely surmounted by the rotation of pastures and the regular administration of vermicides.

Profits are secured by the production and sale of spring lambs for which purpose it is necessary to use a ram of good mutton type. Common ewes may be used in starting, but these, as in the case of

beef cattle, should be improved by selection from the lamb crop. The sale of wool from the breeding flock should go far toward paying for the winter feed. About the same amount of feed per 1000 pounds weight should be allowed as for cattle.

While there is no well established market for goats, a few of these animals are useful in helping destroy brush and weeds in pastures. They are quite hardy, seldom being affected with internal parasites as is the case with sheep. Grubs in the head attack goats as well as sheep, but this may be prevented by smearing the nose with tar during the summer season. The flesh of goats when properly dressed can scarcely be distinguished from mutton and a good local market for a few of these animals is a possibility.

A few sheep and goats often increase the value of cattle pastures as the former eat many weeds not relished by cattle, and the latter, being browsers by nature, are a great aid in destroying shrubs and bushes as well as weeds.

Dairy Cattle

Dairy farming differs from the production of beef cattle in a number of important respects. These may be enumerated as follows: they require a more constant labor supply; they call for a larger amount of feed and feed of higher quality; they should be provided with better housing; and the product calls for delivery to market at least twice per week in winter and oftener in summer, depending on the product marketed and storing facilities on the farm. What has been said in regard to pastures for beef animals is applicable also to the keeping of dairy cattle although the necessity for good pastures may not be so pronounced where one is situated where he has the advantage of the best market. Feed allowance may be roughly estimated at 1.5 tons of high quality hay per 1000 pounds weight and one pound of concentrate per three pounds of milk produced with about 50 per cent additional concentrate for calves, heifers and bulls. Where silage is available, about three pounds is equivalent to one pound of hay. This allowance is in addition to a reasonably good pasture.

Dairy products may be marketed in various forms and by a number of methods, depending for their profitableness on the market available, the location of the farm in relation to the market, and the dairy equipment on the farm. These may be enumerated as follows: retailing whole milk, cream, buttermilk and butter in bottles or packages, wholesale cream to creamery, cream station or ice cream plant, and wholesaling whole milk to a distributor, condensery or cheese plant. In addition, there are possibilities in the area for producing dairy cows and heifers for sale.

Retailing calls for delivery once or twice daily which is practiced only when the farm is located near a consuming center sufficiently large to take the output at satisfactory prices. These prices must necessarily be considerably above wholesale prices since land so located is ordinarily more valuable, buildings must be more sanitary and expensive, more equipment is necessary and more labor is involved.

Selling cream permits the farm to be located farther from the market than any other method unless one considers the selling of butter from the farm, a practice which is rarely found and about as

rarely profitable. Cream may be delivered as seldom as twice per week in mid-winter although such seldom delivery is rarely advisable, due to the cost of proper cooling and storing equipment. Markets for cream are ordinarily the first type of wholesale market established in a community, and at the present time, it is the most common wholesale market of the area. This method of marketing does not require an excessive amount of equipment and transportation charges are relatively low. Sanitary restrictions are not so stringent as in the production of products for retail, yet reasonably high standards of sanitation are ordinarily profitable by reason of a higher quality product obtained. This method also has the advantage of retaining the skim-milk on the farm where it has a feeding value per 100 pounds roughly estimated as equal to one-half bushel of corn. It may be used in rearing heifer calves, and for the production of pork or poultry products.

Wholesaling whole milk calls for delivery of sweet milk once or

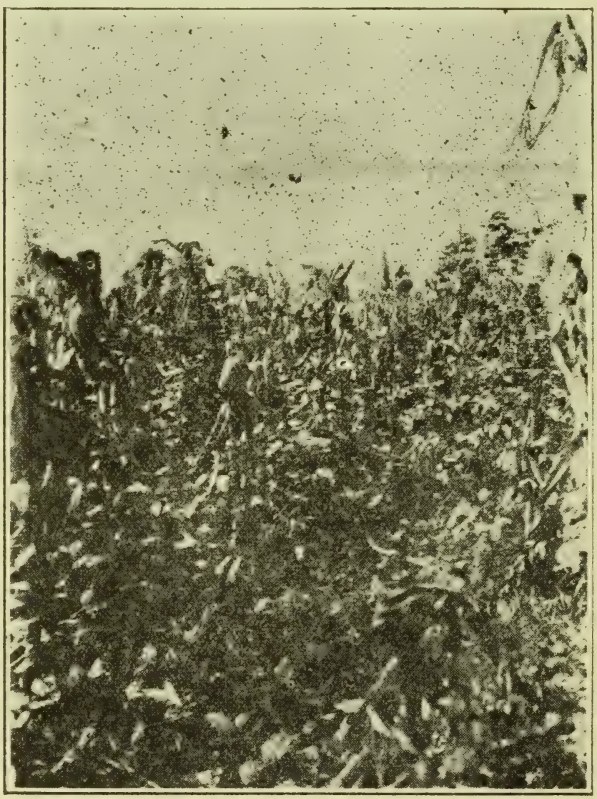

Figure XVII. The lower farm lands will produce excellent corn and peas which may be harvested or grazed by hogs. The corn in the picture was topped to obtain roughage for mules. Such roughage is very expensive if the time used in topping has any value.

twice daily. The cost of equipment is about the same as that where cream is sold, some additional cans and a cooler being needed instead of a separator. Sanitary standards must be sufficiently high to insure the delivery of milk sweet and comparatively free from foreign matter. Transportation charges are relatively high, and the marketing of whole milk is conducive to neglect of calves needed for replacement in the dairy herd.

In anticipation of the enforcement of the stock dipping law and quarantine regulations, many of the cattle of the area were disposed of a few years ago. The demand for dairy animals is now good in the area and dairy development in communities north of the quarantine territory has created an excellent market available as soon as the quarantine is lifted. The market outlook for well bred dairy heifers and cows is exceptionally bright.

Only pure bred bulls from cows of known high production should be used, whether one is producing animals or products for market.

Where the income is to be derived from the sale of animals, they may be handled similar to beef cattle, with perhaps somewhat better care, and whether one sells animals or products, it will rarely pay to keep bull calves. These should be killed at birth, since either cows, heifers or sheep will return more from pasture while heifers, hogs or chickens will return more for skimmilk.

Hogs

Because of the difficulty of producing corn in South Mississippi, the production of hard finished hogs for market in the area will be found profitable only on especially well favored farms. However there are possibilities for successful hog production on certain crops adapted to the area and especially in connection with certain types of dairying.

Although hogs are not usually considered as grazing animals, adequate pastures are necessary for success. Where fences are adequate hogs may be grazed with other types of livestock without serious consequences to either the pasture or the stock, if the precaution is taken to place nose rings in the hogs and separate the animals at calving or lambing time.

A suggested practice is to pasture the sows and pigs on bermuda, lespedeza, rape, and oat pasture and finish by grazing sweet potatoes, peanuts, chufas, soybeans and such corn as is available. Where corn is the principal concentrate, a protein supplement is essential. This may be supplied by feeding skimmilk or tankage. Where tankage is used the ratio should be about one pound of tankage to fifteen pounds of corn. The digestible protein in one pound of tankage is approximately equal to that contained in fifteen pounds or almost two gallons of skimmilk. Successful pork production requires well bred hogs and reasonably sanitary surroundings. Such hogs under such conditions with plenty of water and good pasture should make a pound af gain on 4.5 pounds of corn and .3 pounds of tankage or their equivalent in other feeds.

Poultry

While a specialized poultry business requires considerable close attention to details for success, very few farm enterprises return more for the investment and fit in as well with other lines of farming as does poultry. Farmers of the Longleaf Pine section, generally, may

profit by improving their poultry enterprises and many of them might profitably increase the size of the farm flock. Where conditions are favorable and reasonably good management practices followed, highly specialized poultry farms should succeed.

The principal factors on which success depends are so few and simple that it is surprising that they are not recognized by more poultry keepers. A flock composed of a single breed and variety, hatched early, well fed, well housed and provided with sanitary surroundings sums up the main points in a single sentence. The flock should consist of a single variety in order to insure uniformity of product whether it be eggs or birds. Early hatching and good feeding enable the producer to meet the demand for poultry products when seasonal prices are ordinarily high. Proper housing and sanitary surroundings are necessary for the health of the flock and maximum production. In addition to the above points, the flock should be culled periodically and the non-layers marketed.

The following estimates are based on recommendations of the Poultry Department, A. & M. College, Mississippi, and records kept by poultrymen of South Mississippi under the supervision of the Extension Service. The unit is a flock of 300 hens which may be successfully kept on two acres of well drained land with preferably a sandy soil. If all feed is to be grown, additional land will be necessary.

Housing should consist of one laying house, $300; three colony houses at $150 each, $450; and one brooder house, $150. The first year, the laying house could be used in place of the colony houses, deferring the building of the latter until the second year. Only such fencing as would be necessary to protect crops and prevent trespassing on the property of others would be necessary. This would depend on the location of the enterprise and other interests of the owner. Cost of materials for fencing consisting of posts 8 feet apart and 72 inch poultry wire topped by two light barbed wires would amount to about $1.10 per rod when posts are valued at 25 cents each. Such a fence would be necessary to confine the strictly laying breeds. For the heavier breeds, this height of the fence is not necessary and the cost would be approximately 25 per cent less. Equipment, such as feeders and nests would be built in and covered by the building cost.

The feed allowance should be 70 pounds per hen per year for the light breeds and 80 pounds for the heavy breeds. Of this allowance, 55 per cent should be grain and 45 per cent mash. To replace one-half of the laying flock with pullets each year would require approximately 15 pounds additional feed per hen. Green feed should be supplied when range is not available.

Where the above housing conditions are met and feed recommendations supplied, a production of 125 eggs per hen per year should be otained. In addition, there would be the cockerels and cull hens for sale and the value of the manure for use on garden or flowers. A conservative estimate of the return which might be expected is $1.50 per hen, not counting the value of manure which has been estimated at 25 cents.

Whether the marketable product is eggs or poultry, the production of a uniform and high quality product should be the aim. These

products can always be sold at some price, but ordinarily a premium can be obtained for high quality. Eggs for market should be infertile and marketed regularly at intervals of not more than a week in winter and shorter intervals in summer.

Mr. G. R. Sipe, Head of the Poultry Department, A. & M. College, suggests the possibility of building up a retail trade in package eggs similar to the methods of the retail dairymen.

Poultry for market should be well fleshed and uniform in size, sex and color.

Forestry

At the present time, the forest resources of the United States are being consumed at a much greater rate than they are being produced. Lumber products have steadily increased in value for a number of years and already the cost of wood for fuel is being sharply felt in some sections which were formerly well wooded. Virgin timber is becoming increasingly scarce and transportation charges are adding more and more to the cost of forest products. These conditions, in addition to the fact that the climate and much of the land of South Mississippi is particularly well suited to forest growth, makes timber production worthy of serious thought.

The items of expense on this enterprise would consist largely of interest on investment, taxes and protection from fire. Some protection from livestock might also be needed while the seedlings are

Figure XVIII. Natural stands of second growth pine are very common to the section. With adequate fire protection, timber growing constitutes an economic use of the land. With reasonable effort such land can be made into excellent pasture until the forest shades the ground.

young. Seeding, except in rare cases, would take place naturally, although some effort in this direction might prove profitable. The expense of thinning should be offset by the sale of products removed in the form of firewood, staves, posts, etc.

Promiscuous burning over of cut-over lands has been the greatest obstacle to reestablishment of forest growth. Many people believe that this keeps the cattle tick in check and improves the grazing. With the extermination of the tick by other means, this incentive to burning will be removed. While burning may improve the grazing for a short time in the early spring, the value of grazing is greatly decreased in the long run by this practice. Certain pasture plants and their seed are entirely destroyed and others are seriously injured. Mowing, where possible, is far superior, and the value of the young forest trees destroyed by fire is ordinarily far greater than the slight seasonal improvement in pasture.

R. D. Forbes, formerly of the Louisiana Forest Experiment Station, has estimated the costs and receipts per acre of reforesting enterprises to be as follows: taxes, 30 mills on an assessed valuation of $3.50, 10.5 cents; fire protection from nothing to 10 cents; planting, if necessary, $6.00; and interest, 6 per cent on a valuation of $5.00, thirty cents. These expenses, using ten cents for fire protection, allowing for planting, and compound interest amount to $36.81, $73.38, $138.87 and $256.14 at the end of 20, 30, 40 and 50 years respectively. Where no planting cost is included, the corresponding amounts are $17.57, $38.92, $77.16 and $145.62. At the present time, $5.00 per thousand is a conservative estimate of pine stumpage value in the South, and with present rates of increase this figure will likely be doubled in the next ten or fifteen years when the first timber may be sold. Using the higher figure and ordinary rates of growth, returns at the end of 20 years of $46 to $49 per acre for loblolly and slash pine and $23 per acre for longleaf pine cord wood may be expected. At the end of 40 years, slash and loblolly pine should yield from $210 to $300, and longleaf, $128, as saw timber. In the case of the latter, turpentining may yield an additional amount equal to one-third of the cordwood value at the end of 20 years and one-fourth of the saw timber value at the end of 40 years, bringing the totals up to $30.29 and $160.00 respectively. With these figures, which are based on average soil and climatic conditions, all except planted longleaf pine at 20 years show a margin of profit above 6 per cent interest, compounded. As this pine is a comparatively slow grower, it should be allowed to stand for a longer period to be profitable.

Combinations of Enterprises

The possibilities for combining enterprises has only been touched upon in the foregoing discussion, but a study of the different enterprises soon leads to the realization that certain of them are complementary or supplementary to others. Each of the enterprises, fruit and truck being considered as one, has been discussed from the standpoint of its being considered for the major source of cash income. It has been assumed that, where the operator makes his home on the land, he will produce on the side sufficient field, garden and livestock products to meet family needs.

Where only one source of cash income is depended on, the opera-

tor could well take a cue from industrial concerns and set aside a fund to take care of unfavorable seasons. Many such specialized farmers are seriously handicapped immediately following a bad year because all income from the better years has been invested in more land or other fixed capital and working capital is scarce. By combining one or more minor sources of income with the major source, hazards of unfavorable seasons are reduced and the business as a whole usually returns a greater net income.

The advantage of combining a number of farm enterprises within reasonable limits lies in making a better use of the time and resources of the farm. Certain enterprises are particularly adapted to each other.

In general, some form of livestock fits in exceptionally well with cropping enterprises. Livestock serve the purpose of supplying an outlet for surplus labor during the winter months when labor requirements for crops are low. They consume unsaleable products, turning them into marketable forms, and are valuable in recovering the value of shattered grains and forage left in the fields after harvest. The manure aids materially in reducing fertilizer bills and maintaining soil fertility. In this respect, beef cattle may be a valuable side line to the production of cotton with only a small amount of time spent on producing winter roughage. Where somewhat more land is adaptable to feed crops and markets are available, dairy cattle fit in well with cotton production. The keeping of sheep and goats in connection with cattle, and the production of pork and poultry products in connection with dairying have already been discussed. Sheep or poultry combine profitably with fruit and truck growing where fencing is adequate, and a combination of trucking with dairying should be profitable under favorable circumstances. Forestry combines well with the production of grazing animals, but in this case some sacrifice must usually be made in one or the other. Forestry growth ordinarily precludes mowing, and burning should not be considered. In addition, tree growth progressively shades the ground and pasture plants die out. With this combination, the animals should be added only after the trees are well established and they should be gradually reduced in numbers as the forest growth progresses.

Farmer relief has been one of the foremost topics of discussion for the past several years. It has now been narrowed down to the point where it appears that the principal aid which the farmer might expect through government agencies must be obtained either directly or indirectly through cooperation.

Cooperation among farmers holds possibilities for increasing profits not only in its broader phases which permit of obtaining financial aid from Federal funds, but also in its more narrow phases wherein two or more neighbors pool their resources for the accomplishment of undertakings quite local in nature. Among the more local objects adaptable to cooperative undertaking may be mentioned the exchange of labor to obtain a better use and distribution of time and perhaps save some cash outlay; the cooperative ownership of male animals and machinery of high unit cost in order to distribute the capital investment and permit full capacity use of the animal or machine where an individual's operations would not justify the outlay; cooperative hauling

and shipping in order to insure full loads and save time and expense; cooperative purchasing in order to obtain the advantages of wholesale buying; and cooperative ownership of gins, warehouses, creameries, curing houses, etc.; to insure proper handling of products, facilitate pooling of products and uniform marketing, and reduce handling expenses. Cooperative marketing of farm products is a phase of the broader field and the benefits to be derived from it are more dependent on the attitude of farmers as a group. It was this type of cooperation that the Federal Farm Board was created to assist, and its success will depend largely on the support which the farmers themselves give it.

Successful cooperation involves several important factors. Confidence of the cooperators in each other and in the management is essential, as well as a willingness to sacrifice individual tastes and prerogatives for the benefit of the group. In this respect, sufficient vision is necessary for the individual to see the advantage of average fair returns covering a long period over a hard bargain driven at the expense of future sales or the sales of others. Honesty and courage are essential—honesty to live up to one's pledge when not legally bound and courage to meet the competition of those opposed to cooperative efforts. Good management, both in organization and operation, is requisite for success. Prior to organization, the proposed business should be thoroughly studied. The functions of marketing are the same for both cooperative and private agencies, and if the cooperative cannot perform the functions more economically than private agencies, it has no reason to exist. The costs of performing these functions should therefore be considered as a first step for a proposed cooperative. Costs of building site, building, transportation facilities and management should be looked into. Other items to consider are probable volume of business, quality of products that it is proposed to handle, storage losses, financing, and market outlets.

From the management standpoint, it should be remembered that the entire marketing structure has been well established by years of custom, and that radical changes can be brought about only by herculean effort and pronounced public opinion. It is therefore necessary for the cooperative manager to use the established marketing machinery at least for the present. The functions involved in marketing may be enumerated as assembling, grading, storing, financing, processing, transportating, packing and distributing. These functions do not necessarily occur in this order, but may occur in varying orders or may be intermingled with each other. They are usually performed by a number of different agencies, and under free competition, each agency would perform that function, or part of it, which it could perform most economically. In ordinary marketing practice, the farmer performs certain of these functions himself as a matter of course. He usually transports his product to the assembling point, although he may grade, process, package, store, finance, or even distribute it. Likewise a cooperative or private agency may perform one or more of these functions, but it is rare indeed that one agency attempts all of them. Wisdom lies in the cooperative choosing to perform only those functions which it can handle on a more economic basis, other things being equal, than the private agencies, and leaving the remainder to

he existing marketing machinery.

Bulletin 159—Clearing Pine Lands.

Bulletin 225—Report South Mississippi Branch Station, 1922, 1923, 1924.

Bulletin 232—Report South Mississippi Branch Station, 1925.

Bulletin 238—Report South Mississippi Branch Station, 1926.

Bulletin 246—Report South Mississippi Branch Station, 1927.

Bulletin 266—Report South Mississippi Branch Station, 1928.

Circular 63—Cotton Experiments, South Mississippi, 1925.

Circular 69—Cotton Experiments, South Mississippi, 1926.

Bulletin 251—Cotton Experiments, South Mississippi, 1927.

Bulletin 180—Pasture and Forage Crops for South Mississippi.

Circular 74—Vetch.

Bulletin 206—The Sweet Potato for South Mississippi.

Circular 57—Sweet Potato Experiments, South Mississippi.

Extension Circular 32—Harvesting, Grading, Storing, and Marketing Sweet Potatoes.

Bulletin 208—Peanuts.

Bulletin 129—Sugar Cane for Syrup Making.

Circular 59—Grape Experiments, South Mississippi.

Bulletin 217—The Satsuma Orange in South Mississippi.

Bulletin 265—Growing Satsuma Oranges in South Mississippi.

Circular 58—Tomato Experiments, South Mississippi.

Circular 39—Cost of Producing Truck in Copiah County, 1921.

Circular 7—Selection, Care and Management of the Beef Herd.

Bulletin 242—Steer Feeding Experiments.

Bulletin 260—Steer Production in Mississippi.

Bulletin 166—Dairying on Cut-over Pine Lands.

Extension Bulletin 12—Growing Hogs in Mississippi.

Circular 78—Fattening the Pig.

Extension Bulletin 26—Helps for Mississippi Poultry Raisers.

BULLETIN No. 277 JULY, 1930

Comparison of One-Year-Old and "June-Bud" Peach Stock for Orchard Planting

By

J. C. C. PRICE, *Horticulturist*

"Wherefore, by their fruits ye shall know them."

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. COLLEGE, MISSISSIPPI
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A good rule to follow in planting an orchard is, "The best is none too good"; but the fruit grower should have a knowledge of nursery stock in order to know how to select trees that are really best. With as many as ten different grades and prices in the peach to select from, the grower is often at sea when he starts to buy. Some try to get the largest trees, believing that they will produce fruit more quickly than the smaller.

The larger trees are one or two years of age, with a root system a year older than the top. They are dormant budded trees, which means that they are budded and held dormant during the winter and start to growing the following spring. The smaller trees are budded in June and start to growing immediately. The same season they are offered for sale by the nurserymen an "June buds." The top and root are of the same season's growth.

The cost of the different grades of peaches varies from a few cents apiece for the smallest grade of June buds to seventy-five cents or a dollar apiece for the six to seven foot trees. The prices charged for the different grades over a period of five years are as follows:

June Buds	4 to 6 inches	3 to 5 cents	Average of 4 cents
	6 to 12 inches	5 to 7 cents	Average of 6 cents
	12 to 18 inches	6 to 8 cents	Average of 7 cents
	18 to 24 inches	8 to 10 cents	Average of 9 cents
	2 to 3 feet	10 to 24 cents	Average of 12 cents
	3 to 4 feet	12 to 18 cents	Average of 15 cents
One-Year	3 to 4 feet	35 to 45 cents	Average of 40 cents
	4 to 5 feet	40 to 60 cents	Average of 50 cents
	5 to 6 feet	50 to 70 cents	Average of 60 cents
	6 to 7 feet	60 to 80 cents	Average of 70 cents

It is plainly to be seen that the over-size one year old trees cost ten times the price of the twelve to eighteen inch June buds.

We are often led to believe that the cost of a product is an index to its value, and for this reason many people have been induced to buy more costly trees. The nurserymen are forced to charge in proportion to the cost of production. The longer a nurseryman is required to grow a tree in the nursery, the greater the cost; hence, the higher prices on one year old trees. The nurserymen have long known the desires of the planters, and have graded their trees as to size and height, and set the prices accordingly. The larger the tree, the more vigorous it was believed to be for orchard planting. Little thought has been given to the different size trees as to ease with which they may be transplanted from the nursery to the orchard, the kind of tree to be produced, and the kind that is the most productive.

An experiment was started by this Station to determine the best grade of peach trees for planting. Six trees of each grade were secured and planted. A duplication was made each year for four consecutive years. The trees of each grade were measured at the end of each growing season and a count of the fruit was made just before the ripening period to de-

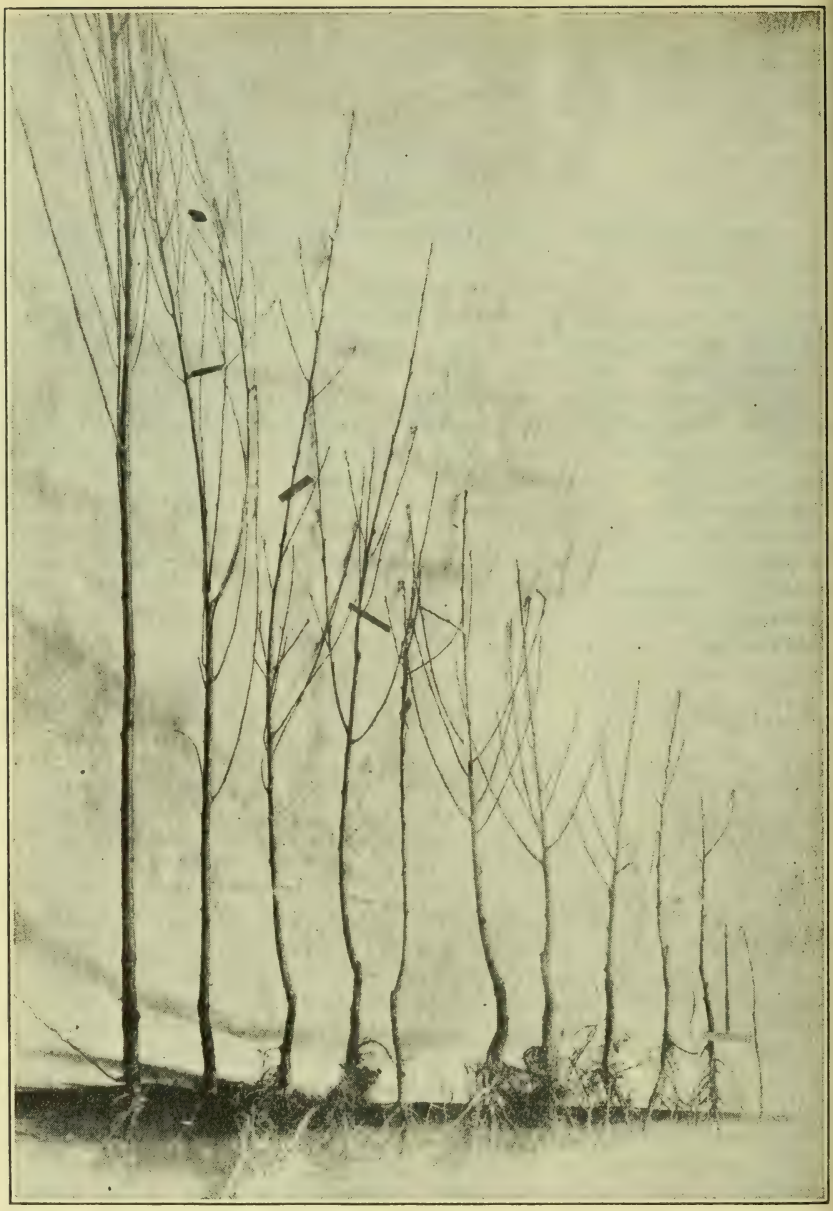


Fig. 1—The ten grades of peach trees as they were received from the nursery

termine the number of fruits on each tree and to determine the best grade to plant. The trees were purchased each year from a reliable nursery, so that representative trees of each grade would be had. Each grade was carefully planted and uniform methods of pruning, spraying, cultivating, etc. were employed. In order to determine the grade making the best trees, annual measurements were made of the leaders, and a count of the number

of leaders; also notes were made as to lateral branches of leaders, if any, and per cent of fruit bud setting.

PEACH TREE GRADES

June-buds are divided into six different grades, according to height. These grades range from four inches to four feet. While the smaller grades make a poor appearance when dug from the nursery, they transplant readily, as most of the root system remains on the tree. Most of the six grades are straight whips well supplied with buds; while the others are well branched, may be headed at the desired height, and may easily be shaped into desirable trees.

The other group of peach trees offered consists of one-year or dormant budded trees. They are budded in August and kept dormant until the following spring, at which time they are allowed to grow. Sometimes, these trees are sold according to height and sometimes according to caliper, or both. The trees used in this experiment were graded according to height, and will be spoken of in terms of height rather than caliper throughout this bulletin. The one-year trees are divided into four grades, three to four foot, four to five foot, five to six foot, and six to seven foot. Trees of the five to six and the six to seven foot grades could not be secured in 1922. The root system of the one-year group is fair, having grown in the nursery for two seasons. A goodly portion is cut off by the tree digger. As the old rule is applied—take as much off the top as is removed from the root—the tree receives rather a severe shock. Owing to the shock of pruning both top and root, the tree starts growing rather slowly. Many roots are broken, and after proper root pruning, only a minimum root system is left. The tops are heavily branched with few exceptions, and are headed high by the the nurserymen; thereby making it impossible to make desirable headed trees in the orchard.

Fig. 2—12 to 18 inch June bud at end of first season's growth. Note head 14 inches high

Fig 3—18-24 inch June bud at end of 1st season's growth. Note head 23½ inches high

Above is given a description of the different grades as they are received from the nursery. In the following is a brief description of the trees as they have grown in the orchard.

A careful record has been kept on the per cent of June buds and one year old trees that died from transplanting. The two hundred and eight June buds show a dead list of nine or four and three-tenths per cent, while the hundred and sixty-three trees of the one year olds show a loss of thirty-two or nineteen and six-tenths per cent. If the trees sold for the same price, the greater loss of one year trees by transplanting would warrant the planting of June buds. In checking over the grades of June buds, the greatest loss was in the four to six inch trees and the trees to four foot, the largest size. While there was very little difference in loss of the different grades of one year trees, the heaviest loss was with the six to seven foot grades, with an average over the four year period of twenty-five per cent. A ten per cent loss was shown with the four to six inch grade and a five and nine-tenths per cent loss with the three to four foot June buds. The other four grades show an average loss of one and nine-

teen hundredths per cent or twenty-three and one-tenth per cent less than the six to seven foot grade which is sold for the highest price.

In growing an orchard tree, the first consideration is the kind and quantity of fruit produced.

It is mentioned above that larger and older trees have been advertised as coming into bearing more quickly than the June buds. A careful study of charts one, two, and three will show that each grade of June buds produced more fruit than did any grade of one year trees. The only exception was with the four to six inch trees in the first crop. In the second crop this grade was above the best of the one year trees. The average of the crops of the plantings of this grade is six per cent above the average of the crops of the highest producing one year grade. An average of all the crops of June buds and of one year trees shows that 21.5 per cent more

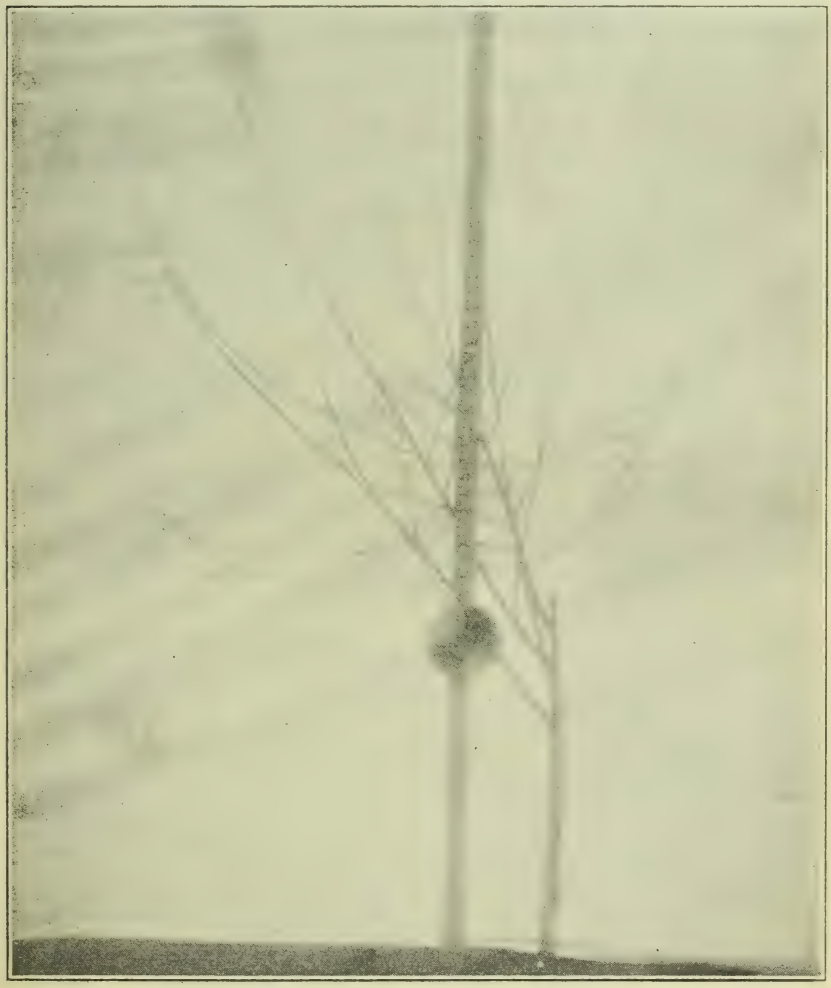


Fig. 4—Large one-year trees at end of 1st season's growth. Note the branches on one side making it practically impossible to properly shape tree. Many of the one-year grades produce this type tree.

Fig. 5—Note trees on left are 4 to 6 inch June buds and trees on right are 3 to 5 foot one-year trees. Note difference in vigor.

fruit was produced by the June buds. The 1925 crop of Elbertas of the 1921 planting shows forty-four per cent more fruit per tree for June buds than was produced by the one year trees. The twelve to eighteen inch June buds proved to be the most productive of all the ten grades. The three to four foot size of the one year trees has yielded the most fruit. In comparing the two grades it is to be seen that the best grades of June buds produced thirty per cent more fruit than was produced by the best grade of one year olds.

A comparison was made of the six to seven foot one year trees with the twelve to eighteen inch June buds as to cost. The data shows that the twelve to eighteen inch June buds in all plantings average nineteen and three-tenths per cent better trees than the six to seven foot trees. The records at hand tend to show that we are paying ten times the money for trees that produce less than half the fruit, when we purchase six to seven foot trees instead of the twelve to eighteen inch June buds. The fruit produced by the twelve to eighteen inch grades of the 1922 planting shows an average of thirty four and seven-tenths per cent more fruit than the four to five foot trees, the largest grade of one year trees sold that season.

The 1919 census reports 593,651 trees not of a breeding age. As peach trees begin to bear at three years of age, we may assume this number of trees not of bearing age are one and two years old. By dividing this number in half we find the annual plantings to be 246,825 trees. The average selling price for one year trees is fifty-five cents, and the average price for June buds is nine cents. If the people of Mississippi will purchase June buds instead of one year trees, it would mean an annual saving of $113,539.50, and twenty one and five tenths per cent better producing trees.

In comparing the different grades of June buds, there is no significant difference in the growth of the first four grades. There is less than 1½ per cent difference between the four to six inch and the six to twelve inch grades. The shape of the tree varies slightly, owing to the distance they are headed above the ground. If the terminal bud is pinched out of the four to six inch or the six to twelve inch trees, they head too low. If allowed to grow without pinching, the tendency is to form a central leader and if not headed at the proper time, it is hard to get a properly shaped

tree. The twelve to eighteen inch and the eighteen to twenty-four inch trees make the best shaped trees of any of the grades. They transplant readily and there is no heading back to do. The grades, six to twelve inch, twelve to eighteen inch, and eighteen to twenty-four inch, show very little difference in the total averages of tree growth. The next two grades of June buds fall behind the four grades mentioned more than twelve per cent in average of total growth.

The trees of these two grades proved the most vigorous of June buds in the nursery row, and, owing to this vigor, have been thought to be the best trees for planting. In comparing the growths, as shown on the chart, there is a gradual decrease in growth in the orchard opposite to that shown in the nursery row. The only way that the falling behind of the larger grades may be accounted for is the shock received in transplanting. The larger the trees, the greater the shock. In checking over the four grades of one year trees, there is a variation of fifteen per cent in the total average, while in the 1921 planting there is a difference of thirty-two per cent between the four to five foot and the six to seven foot grades. The three to four foot grade has made fifteen per cent more growth than the six to seven foot grades of the 1921 planting.

The tendency of the larger trees is to grow shoots of the water sprout type, which have few laterals or fruit buds and not the bushy tree of some of the other grades. Such heavy growth requires drastic pruning, in order to secure the proper shape, and if not severely pruned, the tree becomes so tall that spraying and the harvesting of the fruit is difficult.

In averaging the growth and number of leaders made by each planting, the first year through the fourth planting, six to twelve inch June buds gave the greatest average number of leaders, growth of leaders, and number of laterals. This grade was third in production of peaches in the first crop and second in the second crop. The twelve to eighteen inch grade bore the most fruit of any of the grades. The eighteen to twenty-four inch made the best headed trees. The quality and size of fruit was just as good on the heavy producing trees as on the lighter producing ones.

In summing up the above, June buds are cheaper; express and freight rates are less on this grade; they are easier to plant and make grow; there is less heading back to be done; they are easier to shape into a desirable tree; and they are more productive.

Fig. 6—Trees on left are 3 to 5 foot one-year trees, and those on right are 6 to 12 inch June buds. Note difference in vigor.

The charts were drawn representing the average number of crates produced. The 1921 planting of Elbertas shows an average of two and one half crates for five crops on the eighteen to twenty-four inch trees, with one and one-fourth crates on the six to seven foot trees. The crop for 1929 is not given due to an outbreak of pinhole borers in some plots.

The charts for 1922 planting of Hileys show twelve to eighteen inch trees with an average of three and one-third crates for a six year average. The best one-year average was 1927 when the above grade produced an average of six crates. The best average for one-year trees for six years is two and one-fourth crates. The best crop was produced in 1927—four and one-fourth crates.

The 1927 crop of 1923 planting was quite irregular. The 1923 planting was placed on a rather poor, droughty soil, to which is largely due the irregular crops. The crops of this planting are not in line with those of other plantings.

SUMMARY

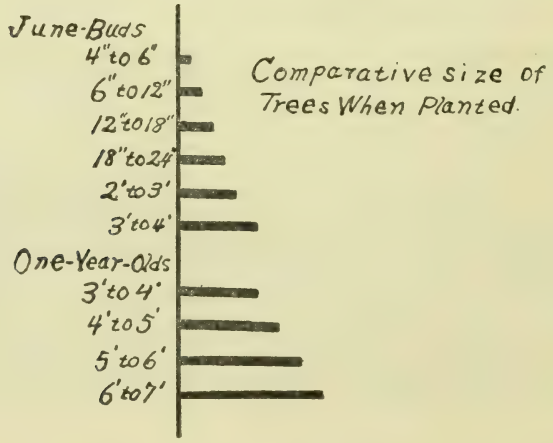
June buds are an average of 83% cheaper than one-year old trees, and produce 21.5% more fruit.

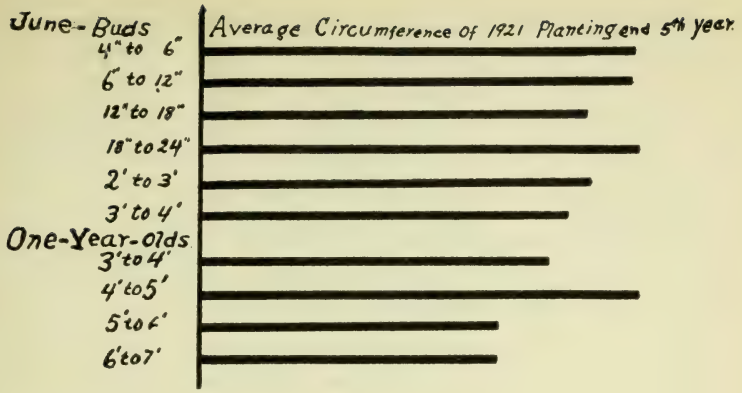
There is 15% more loss in transplating one year trees than in June buds.

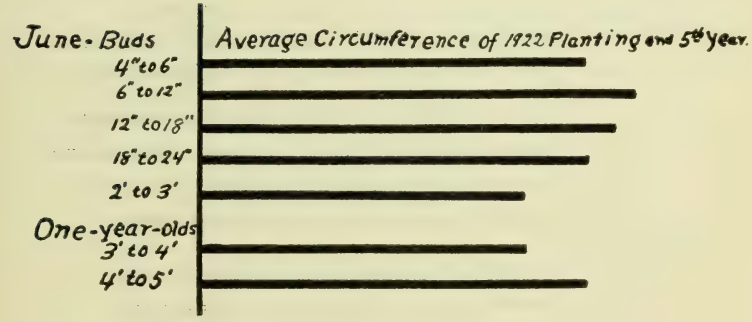
The twelve to eighteen and eighteen to twenty-four inch June buds are the most desirable of all the ten grades for orchard planting. The trees are not overgrown, the bountiful supply of fresh vigorous buds along the young trunk makes it possible to form a perfect head.

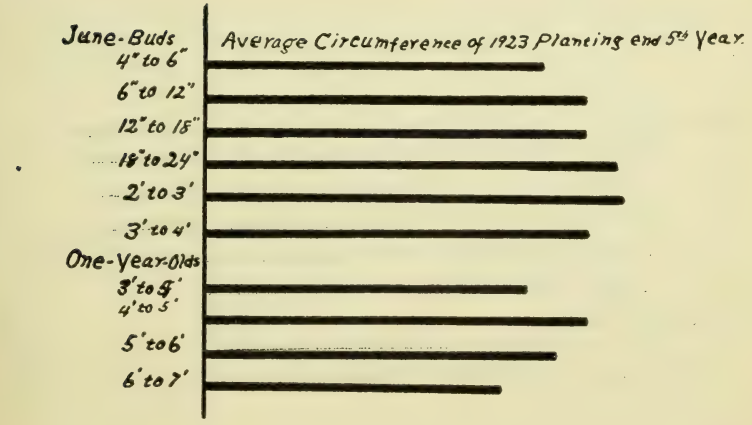
The annual potential saving to Mississippi would be $113,539.50 if June buds are purchased instead of one-year old trees.

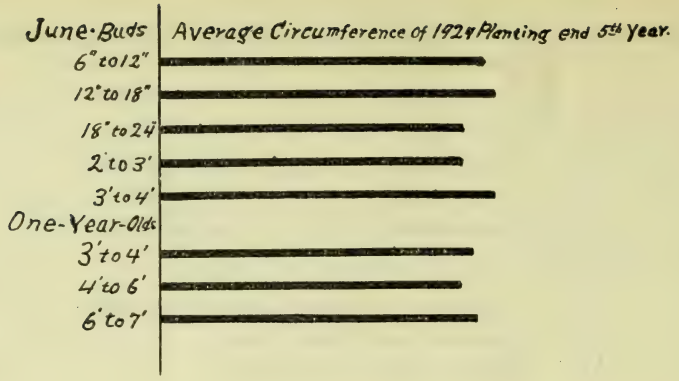
Extra large one-year trees are very hard to shape and rarely make good trees.

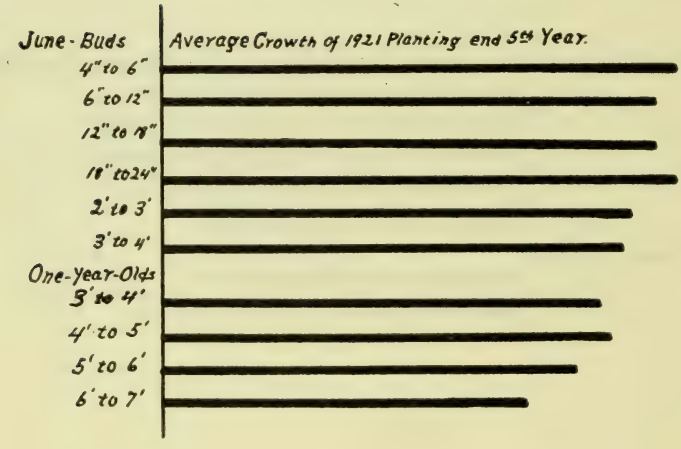


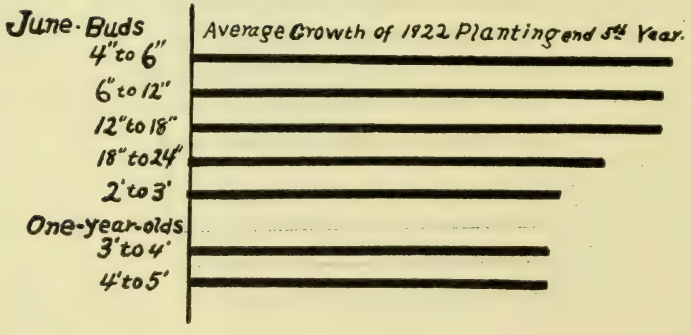

June-Buds
4" to 6"
6" to 12"
12" to 18"
18" to 24"
2' to 3'
3' to 4'
One-Year-Olds
3' to 4'
4' to 5'
5' to 6'
6' to 7'
Average Circumference of 1921 Planting end 5th year.

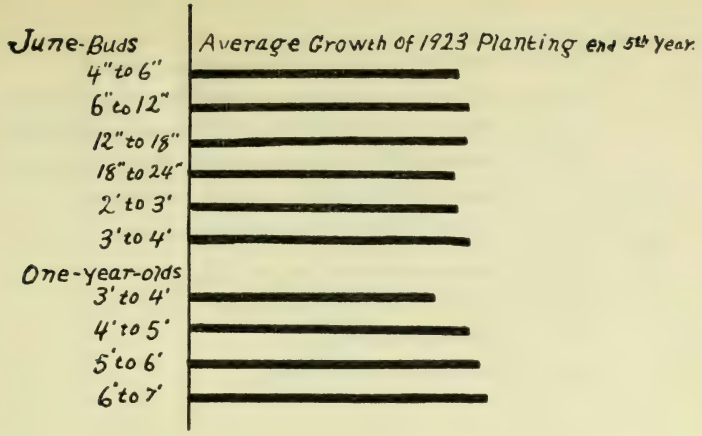

June-Buds
4" to 6"
6" to 12"
12" to 18"
18" to 24"
2' to 3'
One-year-olds
3' to 4'
4' to 5'
Average Circumference of 1922 Planting end 5th year.

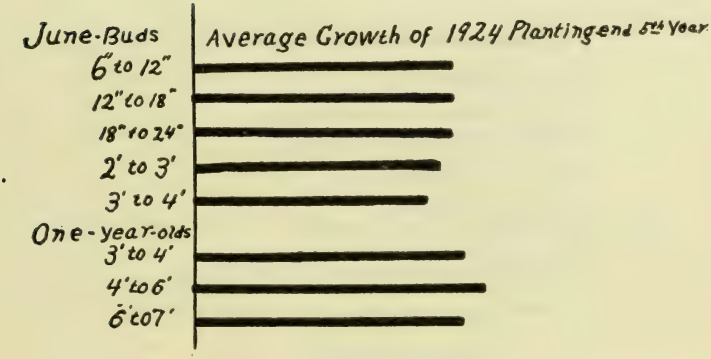

June-Buds
4" to 6"
6" to 12"
12" to 18"
18" to 24"
2' to 3'
3' to 4'
One-Year-Olds
3' to 4'
4' to 5'
5' to 6'
6' to 7'
Average Circumference of 1923 Planting end 5th Year.

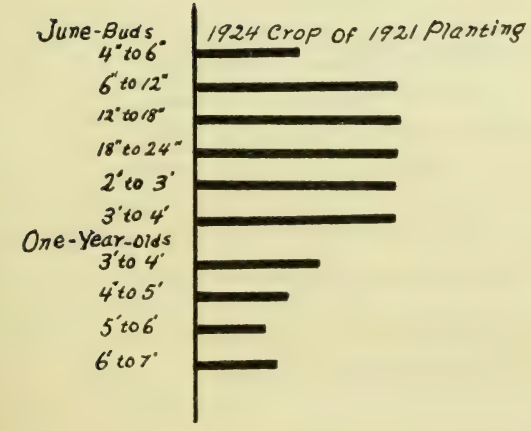

June-Buds
Average Circumference of 1924 Planting end 5th Year.
6" to 12"
12" to 18"
18" to 24"
2' to 3'
3' to 4'
One-Year-Olds
3' to 4'
4' to 6'
6' to 7'

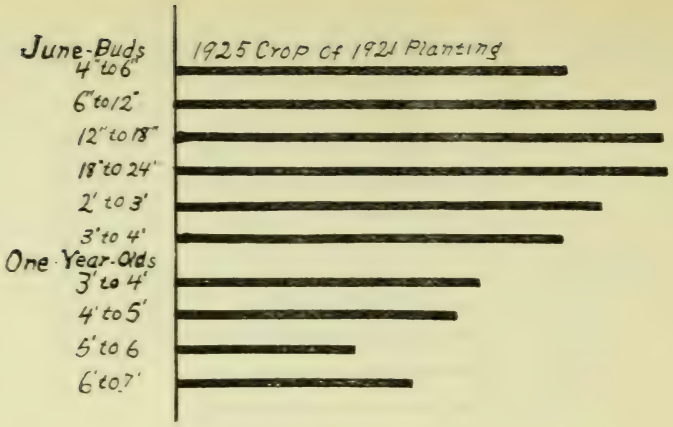

June-Buds
Average Growth of 1921 Planting end 5th Year.
4" to 6"
6" to 12"
12" to 18"
18" to 24"
2' to 3'
3' to 4'
One-Year-Olds
3' to 4'
4' to 5'
5' to 6'
6' to 7'

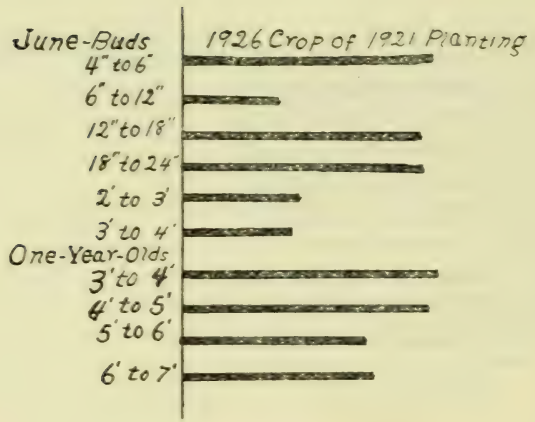

June-Buds
Average Growth of 1922 Planting end 5th Year.
4" to 6"
6" to 12"
12" to 18"
18" to 24"
2' to 3'
One-year-olds
3' to 4'
4' to 5'

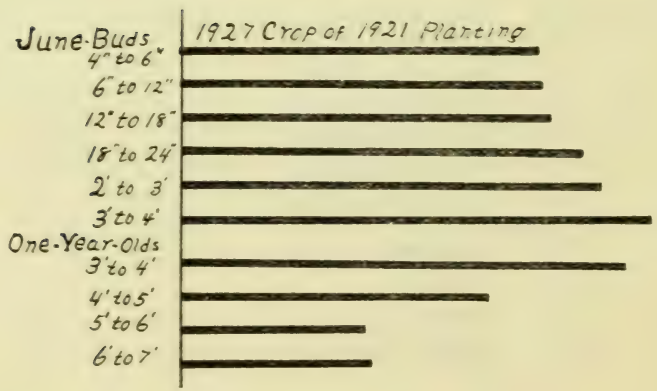

June-Buds
Average Growth of 1923 Planting end 5th Year
4" to 6"
6" to 12"
12" to 18"
18" to 24"
2' to 3'
3' to 4'
One-year-olds
3' to 4'
4' to 5'
5' to 6'
6' to 7'

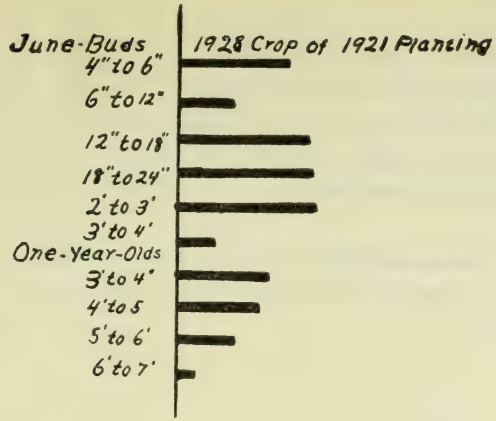

June-Buds
Average Growth of 1924 Planting end 5th Year
6" to 12"
12" to 18"
18" to 24"
2' to 3'
3' to 4'
One-year-olds
3' to 4'
4' to 6'
6' to 7'

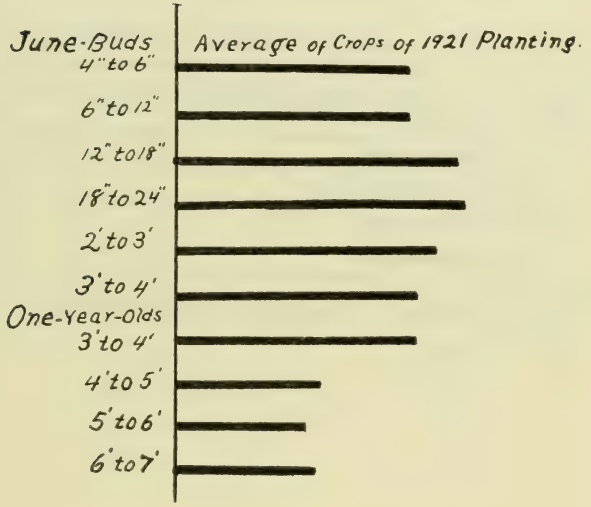

June-Buds
1924 Crop of 1921 Planting
4" to 6"
6" to 12"
12" to 18"
18" to 24"
2' to 3'
3' to 4'
One-Year-Olds
3' to 4'
4' to 5'
5' to 6'
6' to 7'

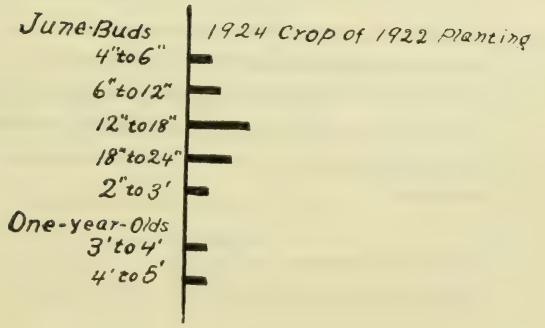

June-Buds
1925 Crop of 1921 Planting
4" to 6"
6" to 12"
12" to 18"
18" to 24"
2' to 3'
3' to 4'
One-Year-Olds
3' to 4'
4' to 5'
5' to 6'
6' to 7'

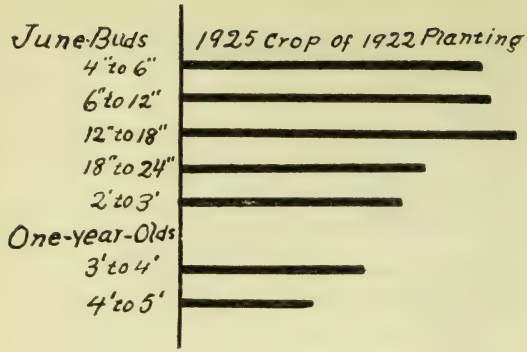

June-Buds
1926 Crop of 1921 Planting
4" to 6"
6" to 12"
12" to 18"
18" to 24"
2' to 3'
3' to 4'
One-Year-Olds
3' to 4'
4' to 5'
5' to 6'
6' to 7'


June-Buds
1927 Crop of 1921 Planting
4" to 6"
6" to 12"
12" to 18"
18" to 24"
2' to 3'
3' to 4'
One-Year-Olds
3' to 4'
4' to 5'
5' to 6'
6' to 7'


June-Buds
1928 Crop of 1921 Planting
4" to 6"
6" to 12"
12" to 18"
18" to 24"
2' to 3'
3' to 4'
One-Year-Olds
3' to 4'
4' to 5'
5' to 6'
6' to 7'


June-Buds
Average of Crops of 1921 Planting.
4" to 6"
6" to 12"
12" to 18"
18" to 24"
2' to 3'
3' to 4'
One-Year-Olds
3' to 4'
4' to 5'
5' to 6'
6' to 7'


June-Buds
1924 Crop of 1922 Planting
4" to 6"
6" to 12"
12" to 18"
18" to 24"
2" to 3'
One-year-Olds
3' to 4'
4' to 5'


June-Buds
1925 Crop of 1922 Planting
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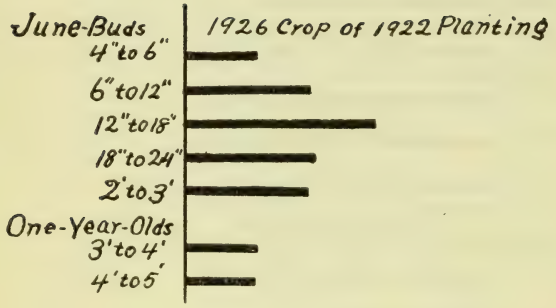
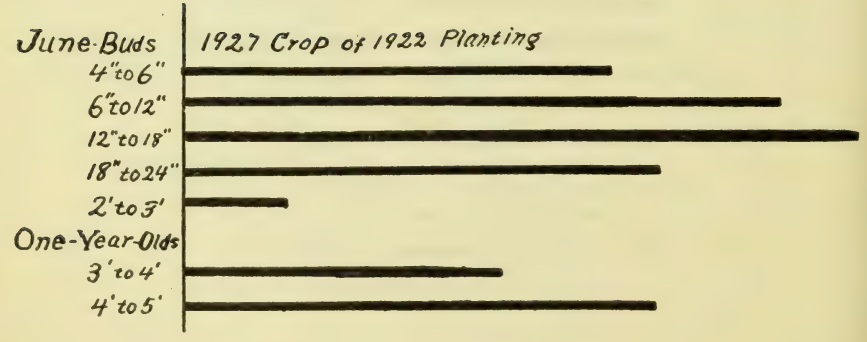
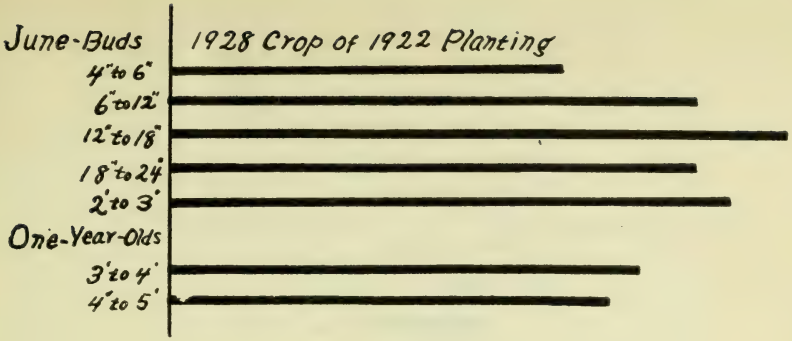
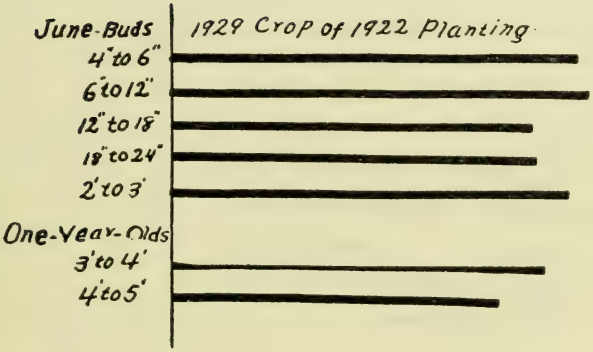
6"to 12"
12"to 18"
18"to 24"
2'to 3'
One-year-Olds
3'to 4'
4'to 5'


June-Buds
1926 Crop of 1922 Planting
4"to 6"
6"to 12"
12"to 18"
18"to 24"
2'to 3'
One-Year-Olds
3'to 4'
4'to 5'


June-Buds
1927 Crop of 1922 Planting
4"to 6"
6"to 12"
12"to 18"
18"to 24"
2'to 3'
One-Year-Olds
3'to 4'
4'to 5'


June-Buds
1928 Crop of 1922 Planting
4" to 6"
6" to 12"
12" to 18"
18" to 24"
2' to 3'
One-Year-Olds
3' to 4'
4' to 5'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1929 Crop of 1922 Planting
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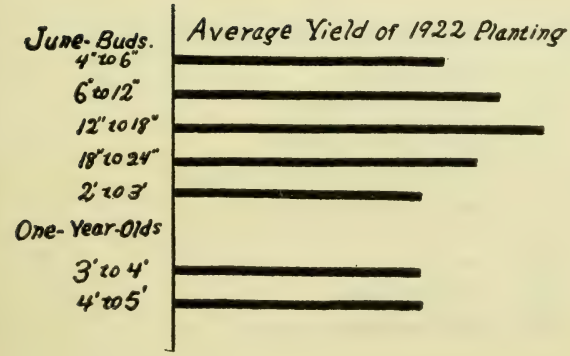
6" to 12"
12" to 18"
18" to 24"
2' to 3'
One-Year-Olds
3' to 4'
4' to 5'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One-Year-Olds
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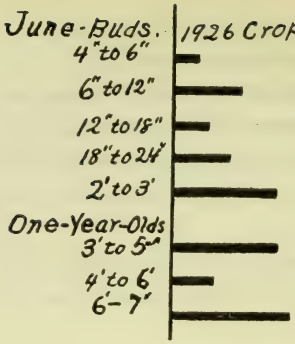
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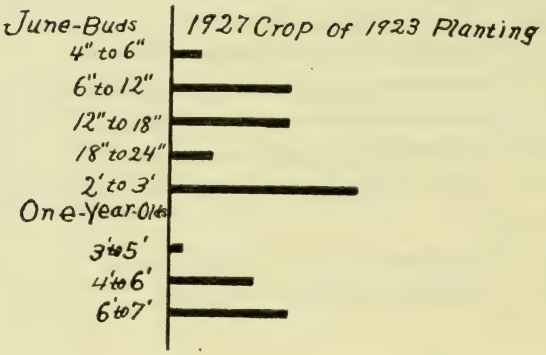
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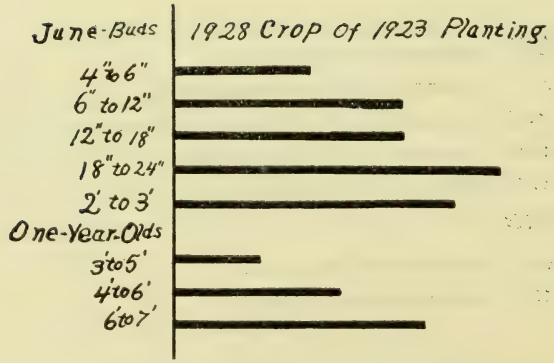
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2' to 3'
One-Year-Olds
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4' to 6'
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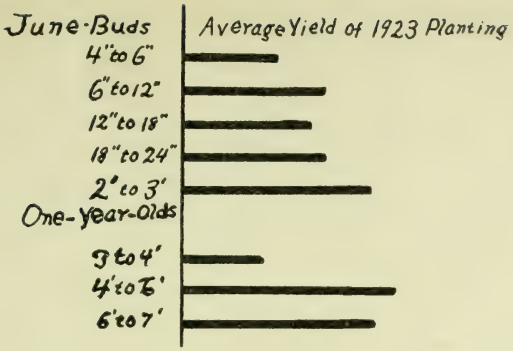
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Average Yield of 1923 Planting
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18" to 24"
2' to 3'
One-year-Olds
3' to 4'
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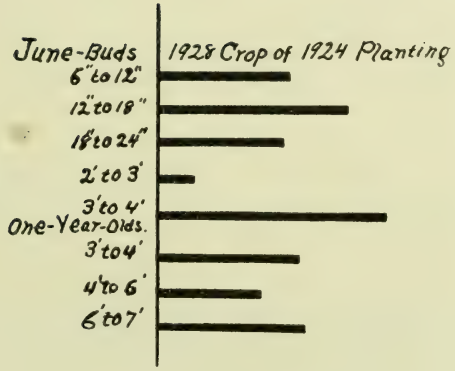
6' to 7'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1928 Crop of 1924 Planting
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18" to 24"
2' to 3'
3' to 4'
One-Year-Olds.
3' to 4'
4' to 6'
6' to 7'

ULLETIN 278 JULY 1930

COMPARISON OF ROUGHAGES FOR FINISHING STEERS

BY

D. S. BUCHANAN

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
J. R. Ricks, Director

Comparison of Roughages for Finishing Steers

By
D. S. BUCHANAN*

INTRODUCTION

Low average yields of corn within the State and high freight rates when feed is bought forces the use of the readily available concentrate cottonseed meal as the main concentrate along with a roughage or roughages to feed cattle in Mississippi. It is well known that such a ration will not finish immature animals; therefore, the method of feeding beef cattle within the State is limited to two-year-old or older cattle. Practically all such available cattle are of native or Jersey stock. Those showing prominence of Jersey blood are referred to locally as Yellow Hammers. These cattle, of course, cannot be fed on high priced feeds and shipped to river markets to compete with grain-fed, high grade steers. It has been found to be profitable, however, to finish such steers on a cottonseed meal and roughage ration and put them on the market in competition with cheaper cattle. Such cattle often find a desirable market in April and May and will always bring a higher price at the season between the heavy run of grain-fed cattle of February and March, and Southwestern grass cattle which usually starts in June.

OBJECTS OF THE EXPERIMENT

The objects of the experiment were to find the most economical ration combination consisting of cottonseed meal and roughages for the finishing of common mature steers, also to compare the yield and production costs of those silage crops best suited to Mississippi conditions.

PLAN OF EXPERIMENT

The experiment has been conducted for a period of three years and in each of the three tests representative groups of common native cattle, mostly of Jersey breeding and two years old or over have been used. The steers were weighed on three consecutive days at the beginning of the period and were divided as nearly as possible into equal lots according to size, type, and breeding. The averages of the three consecutive weights at the beginning and at the end of the experiment were taken as the initial and final weights. Intermediate weights were taken at fourteen day intervals and all weights were taken as near 10 a. m. as possible. The first test was for a period of ninety-three days and the last two tests each continued for a period of one hundred and twenty days.

All lots were fed twice each day and the times of feeding, 6:30 a. m. and 4:30 p. m., were as regular as possible. The rations by lots were as follows:

Lot I Cottonseed meal 6.5 pounds Corn silage ad libitum Johnson Grass hay 3 pounds	Lot III Cottonseed meal 6.5 pounds Sorghum silage ad libitum Johnson Grass hay 3 pounds
Lot II Cottonseed meal 6.5 pounds Cottonseed hulls ad libitum Johnson Grass hay 3 pounds	Lot IV Cottonseed meal 6.5 pounds Sagrain silage ad libitum Johnson Grass hay 3 pounds

A fifth lot was added at the beginning of the second experiment and was fed as follows:

Lot V Cottonseed meal 6.5 pounds
Johnson Grass hay ad libitum

*C. J. Goodell planned and conducted the experiment in 1926-27.

The cottonseed meal in the last two tests was fed in the beginning at the rate of two pounds per head daily. This amount was increased one pound each fourth day until six pounds was being fed. This amount was continued through the first sixty days of the test. Seven pounds was fed for the next thirty days and eight pounds was fed during the last thirty days of the test.

Fresh hydrant water and block salt were available at all times.

CATTLE USED

Native grade Jersey or Yellow Hammer steers were used in all of the experiments with the exception of the first year when there were two grade steers in each lot. The steers used the first year, 1926-27, weighed approximately 800 pounds and were delivered to the feed lot for $5.50 per hundred weight. The steers used the second year, 1927-28, weighed approximately 725 pounds and were placed in the feed lot at a cost of $5.75 per hundred weight. The steers used in the third year, 1929-30, averaged approximately 875 pounds and were placed in the feed lot at a cost of $7.50 per hundred weight. The cattle used in 1929-30 were exceptionally fat for grass cattle and it is the writer's opinion that this caused the smaller daily gains made in comparison with other years.

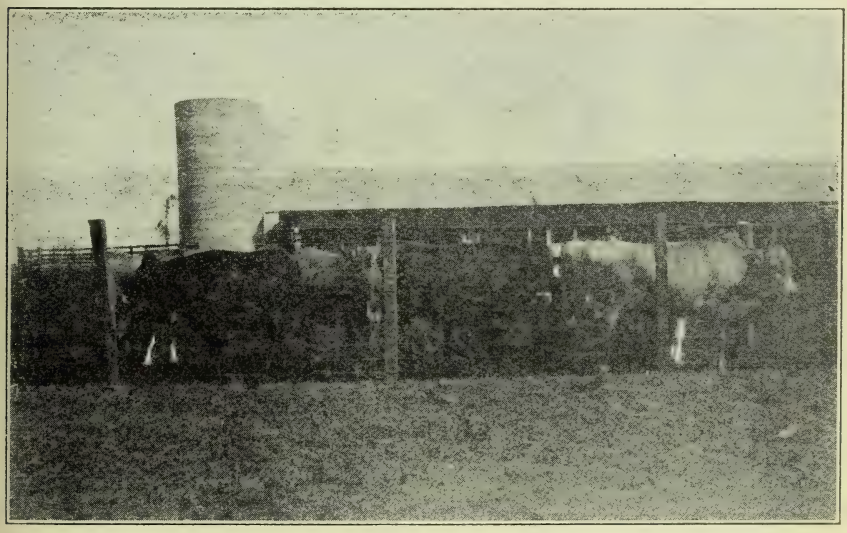

Figure 1. Fat Yellow Hammer Steers—Lot I 1927-28.

FEED USED

Cottonseed Meal

The cottonseed meal was purchased on bid for prime cottonseed meal. Analyses were run by the State Chemist and are reported in Table 1.

Cottonseed Hulls

Cottonseed hulls were purchased on bid and no analysis of the material was made. Delinted hulls were used in the third year of the experiment. In each test, the cottonseed hulls were clean, new, and of good quality.

Johnson Grass Hay

Johnson grass hay used in all experiments was produced on the Station farm and probably all would have graded No. 1.

Corn Silage

Goliad corn, a heavy forage producing white corn, was the variety used in the test. As stated, one of the objects of the experiment was to compare

Figure 2. Honey Sorghum, Corn, and Sagrain.

the yield of different silage plants. In each silage field the three silages were produced on adjoining plots. Careful estimates of yields were made each year and the corn silage yielded in 1926 8.2 tons per acre; in 1927, 7.93 tons per acre; and in 1929, 8.07 tons per acre. Silage samples were taken

at intervals during the feeding period and the analyses made by the State Chemist are shown in Table 1.

Sorghum Silage

Honey Sorghum, commonly called Texas Ribbon Cane in this section, was used for sorghum silage production. This is an extremely heavy producing variety and the following tonnages were produced during the three-year period:

1926—19.70 tons
1927—18.33 "
1928—20.81 "

Figure 3. Cutting 1927 Crop of Honey Sorghum.

Sagrain Silage

This is a new plant or is a variety of Kaffir very closely related to the so-called Shrock sorghum. It has been very successfully used in the Mississippi Delta in producing sorghum fodder for mule feeding. This crop, under Delta conditions, produced in a test and reported in Circular No. 72 of this station, 25 to 45 bushels of grain per acre on soil where corn produced from nothing to 12 bushels per acre. The heads are either harvested and fed as grain or the entire plant is cut, cured, and fed in bundles. Previous silage tests with this particular variety are unknown.

Considerable difficulty was experienced in producing a high grade silage from this plant. The first year the silage was black in color, foul in odor, and kept very poorly. The second year the crop was allowed to stand in the field until it was considerably more mature than in the first year and much better silage was produced. The third year the crop was not cut until the seed were mature and beginning to shatter. Water was added as the silage was put in the silo and a much better quality of silage was produced than in pre-

vious years. It was, however, considerably darker in color and not so pleasant in odor as either the corn or sorghum silages. The yields for the three-year period are as follows:

1926— 9.6 tons
1927— 9.85 "
1928—12.24 "

Analyses of this silage were made as in the case of the other two by State Chemist and are reported below:

TABLE 1

*Chemical Analyses of Feeds Used in Test

Feed	Number of Analyses	Moisture	Ash	Crude Protein	Crude Fat	Crude Fiber	Nitrogen free Extract
Cottonseed Meal							
1926-27	3	6.91	7.01	40.59	7.66	9.14	28.69
1927-28	5	8.05	6.57	42.55	6.84	8.09	27.90
1929-30	2	6.19	6.35	43.07	6.76	8.96	28.67
Corn Silage							
1926-27	2	76.52	1.32	2.15	.70	6.90	12.41
1927-28	2	70.08	1.61	2.36	.86	7.27	17.72
1929-30	2	71.68	1.51	2.17	.99	7.16	16.49
Sorghum Silage							
1926-27	2	75.60	1.29	1.90	.51	6.95	14.65
1927-28	2	77.78	1.31	1.36	.78	6.10	12.67
1929-30	2	75.80	1.19	1.08	.94	6.69	14.30
Sagrain Silage							
1926-27	2	77.83	1.86	2.00	.73	6.04	11.54
1927-28	2	62.31	2.43	3.10	1.19	8.46	22.51
1929-30	2	61.44	2.21	2.57	1.22	9.72	22.84

*All analyses made by W. F. Hand, State Chemist.

TABLE 2

Feed Prices

Feed	Year	Price per Ton
Cottonseed Meal*	1926	$25.00
	1927	40.00
	1929	38.50
Cottonseed Hulls*	1926	4.50
	1927	8.30
	1929	8.30
Johnson Grass Hay**	1926	12.00
	1927	12.00
	1929	12.00
Corn Silage**	1926	4.98
	1927	4.75
	1929	5.25
Sorghum Silage**	1926	2.82
	1927	2.78
	1929	2.82
Sagrain Silage**	1926	4.44
	1927	4.06
	1929	3.89

*Actual price. **Estimated price.

FEED PRICES

The cottonseed meal and cottonseed hull prices reported are actual costs for the particular year indicated. The price used for Johnson Grass hay is the usual price for No. 1 hay in this state. The method of determining the cost of silage as outlined in Mississippi Station Bulletin No. 229 was followed in

determining the cost of all silages. The tonnage produced is reported elsewhere. The prices for all feeds are shown in Table 2, page 6.

A comparison of the feeding value of the silages with that of cottonseed hulls was made in the following manner:

The amount of beef produced by 100 pounds of hulls and a certain amount of cottonseed meal was determined on basis of daily gain and daily ration consumed. Then the amount of silage necessary to produce a like amount of gain was computed. If during this time more cottonseed meal was required by the silage-fed steers than by the hull-fed steers, the amount of silage that could be purchased with the meal was added to the silage that would equal 100 pounds of hulls. If the amount of meal was less in the silage lot, a reduction of silage was made. The small difference in amount of hay in the lots being compared was considered negligible. By this computation in these three experiments, 100 pounds of cottonseed hulls equalled 189 pounds of corn silage, 272 pounds of sorghum silage, or 249 pounds of sagrain silage.

Figure 4. Sagrain Heads, Left, and Honey Sorghum, Right.

Figure 5. Lot II, 1927-28. Cottonseed hull fed steers.

Figure 6. Lot III, 1927-28. Sorghum silage fed steers.

SUMMARIES BY YEARS

In the following tables, the complete data by years is given.

TABLE 3—1926-1927 Test

Date of Test—December 22, 1926, to March 25, 1927.
Length of Test—93 Days.
Breeding of Steers—Native Yellow Hammer and two grade steers in each lot.
Age of Steers—Mature.

	Lot I C. S. Meal Corn Silage Johnson Grass hay	Lot II C. S. Meal Cottonseed Hulls Johnson Grass hay	Lot III C. S. Meal Sorghum Silage Johnson Grass hay	Lot IV C. S. Meal Sagrain Silage Johnson Grass hay
Number of steers per lot	10	10	10	10
Average initial wt. (lbs.)	805.00	801.50	802.30	802.30
Average final wt. (lbs.)	1011.40	979.50	971.30	953.30
Average daily gain (lbs.)	2.22	1.91	1.82	1.62
Initial cost per cwt. in feed lot (dollars)	5.50	5.50	5.50	5.50
Average daily feed for steers				
Cottonseed meal (lbs.)	6.37	6.37	6.36	6.37
Silage (lbs.)	52.10	—	50.00	53.00
Cottonseed hulls (lbs.)	—	25.00	—	—
Johnson Grass hay (lbs.)	3.00	3.00	3.00	3.00
Feed required per cwt. of gain				
Cottonseed meal (lbs.)	286.80	332.60	350.00	392.10
Silage (lbs.)	2348.80	—	2553.30	3263.90
Cottonseed hulls (lbs.)	—	1304.20	—	—
Johnson Grass hay (lbs.)	137.10	160.70	169.20	189.40
Cost of 100 lbs. gain (dollars)	10.26	8.06	9.27	13.28
Shrink (per cent)	6.16	6.94	6.48	4.64
Dressing per cent (warm weight)	55.20	55.60	55.70	55.50
Financial Statement:				
Initial cost per steer (dollars)	44.26	44.83	44.13	44.13
Cost of feed per steer (dollars)	21.14	14.31	15.62	20.02

(Continued on next page)

Table 3—Continued

	Lot I	Lot II	Lot III	Lot IV
Shipping and selling cost per steer (dollars)	6.06	5.82	5.80	5.81
Total cost of steer (dollars)	71.46	64.96	65.55	69.96
Price received per steer (dols.)	79.72	77.48	74.48	74.99
Necessary selling price per cwt. to break even (dols.)	7.53	7.13	7.21	7.69
Selling price per cwt. (dollars)	8.40	8.50	8.20	8.25
Profit or loss per steer (dols.)	8.26	12.52	8.93	5.03

Figure 7. Lot IV, 1927-28. Sagrain silage fed steers.

Figure 8. Lot V, 1927-28. Johnson Grass hay fed steers.

TABLE 4—1927-1928 Test

Date of Test—December 8, 1927, to April 6, 1928.
Length of Test—120 Days.
Breeding of Steers—Native Yellow Hammer.
Age of Steers—Mature.

	Lot I C. S. Meal Corn Silage Johnson Grass hay	Lot II C. S. Meal C. S. Hulls Johnson Grass hay	Lot III C. S. Meal Sorghum Silage Johnson Grass hay	Lot IV C. S. Meal Sagrain Silage Johnson Grass hay	Lot V C. S. Meal Johnson Grass hay
Number of steers per lot	8	8	8	8	8
Average initial wt. (lbs.)	728.7	727.7	727.6	726.8	728.3
Average final wt. (lbs.)	962.7	965.6	952.0	936.2	931.4
Average daily gain (lbs.)	1.95	1.98	1.87	1.74	1.69
Initial cost per cwt. (dollars)	5.75	5.75	5.75	5.75	5.75
Average daily feed per steer:					
Cottonseed meal (lbs.)	6.55	6.55	6.55	6.55	6.55
Silage (lbs.)	43.35	—	50.96	42.53	—
Cottonseed hulls (lbs.)	—	21.88	—	—	—
Johnson Grass hay (lbs.)	3.00	3.00	3.00	3.00	21.11
Feed required per cwt. gain:					
Cottonseed meal (lbs.)	335.88	330.84	350.29	376.43	387.56
Silage (lbs.)	2222.19	—	2725.34	2444.20	—
Cottonseed hulls (lbs.)	—	1105.16	—	—	—
Johnson Grass hay (lbs.)	153.84	151.53	160.44	172.41	1249.09
Cost of 100 lbs. gain (dollars)	12.91	12.12	11.72	13.52	15.24
Shrink (per cent)	7.35	8.70	8.04	8.60	6.21
Dressing per cent (warm wt.)	56.20	55.51	53.89	54.24	53.97
Financial statement:					
Initial cost per steer (dollars)	41.90	41.84	41.84	41.79	41.89
Cost of feed (dollars)	30.22	28.78	26.38	28.24	30.92
Shipping and selling cost (dollars)	5.51	5.44	5.41	5.35	5.46
Total cost (dollars)	77.63	76.06	73.63	75.38	78.37
Price received per steer (dollars)	98.11	96.98	94.99	91.99	93.91
Necessary selling price per cwt. to break even (dols.)	8.70	8.62	8.41	8.80	8.97
Selling price per cwt. (dollars)	11.00	11.00	10.85	10.75	10.75
Profit or loss (dollars)	20.48	20.92	21.36	16.61	15.54

TABLE 5—1929-1930 Test

Date of Test—November 26, 1929, to March 26, 1930.
Length of Test—120 Days.
Breeding of Steers—Native Yellow Hammer.
Age of Steers—Mature.

	Lot I C. S. Meal Corn silage Johnson Grass hay	Lot II C. S. Meal C. S. Hulls Johnson Grass hay	Lot III C. S. Meal Sorghum Silage Johnson Grass hay	Lot IV C. S. Meal Sagrain Silage Johnson Grass hay	Lot V C. S. Meal Johnson Grass hay
Number of steers per lot	8	8	8	8	8
Average initial wt. (lbs.)	878.12	878.75	875.41	873.54	875.62
Average final wt. (lbs.)	1093.12	1087.00	1052.29	1076.04	1024.37

(Continued on next page)

Table 5—Continued

	Lot I	Lot II	Lot III	Lot IV	Lot V
Average daily gain (lbs.)	1.79	1.74	1.47	1.69	1.24
Average daily ration:					
Cottonseed meal (lbs.)	6.41	6.41	6.41	6.41	6.41
Silage (lbs.)	49.88	—	51.81	46.73	—
Cottonseed hulls (lbs.)	—	23.64	—	—	—
Johnson Grass hay (lbs.)	3.00	3.00	3.00	3.00	24.54
Feed required per cwt. of gain:					
Cottonseed meal (lbs.)	358.06	368.38	436.01	379.28	516.90
Silage (lbs.)	2786.30	—	3524.12	2765.01	—
Cottonseed hulls (lbs.)	—	1358.59	—	—	—
Johnson Grass hay (lbs.)	167.58	172.41	204.06	177.51	1978.91
Cost of 100 lbs. gain (dollars)	15.16	13.92	14.56	13.78	21.82
Shrink (per cent)	6.37	9.20	8.29	9.66	7.16
Dressing per cent (warm wt.)	57.06	55.91	56.25	57.06	56.28
Financial statement:					
Initial cost per steer (dollars)	65.86	65.91	65.66	65.51	65.67
Cost of feed (dollars)	32.68	28.74	25.74	28.13	32.46
Shipping and selling cost (dollars)	6.05	5.83	5.69	5.74	5.61
Total cost (dollars)	104.59	100.48	97.09	99.38	103.74
Price received per steer (dollars)	111.05	103.63	98.91	102.07	97.48
Necessary selling price per cwt. to break even (dollars)	10.21	10.18	10.06	10.22	10.90
Selling price per cwt. (dollars)	10.85	10.50	10.25	10.50	10.25
Profit or loss per steer (dollars)	6 46	3.15	1.82	2.69	-6.26

SUMMARY AND RECOMMENDATIONS

In this three years' work, the corn silage yield was 8.07 tons; sorghum silage, 19.61 tons; and sagrain silage, 10.56 tons.

For thin lands and where rainfall is variable, sorghum is far more certain than corn as a silage crop and will produce a much greater tonnage per acre.

Sagrain as a silage crop is particularly adapted to the buckshot soil of the Mississippi Delta.

Sagrain is not as easily cured into bright, palatable silage as the other two crops and the cutting should be delayed as long as possible or until the seed begin to shatter.

Cottonseed hulls are available and in combination with cottonseed meal and a small amount of hay, give satisfactory results when fed to mature steers.

In these experiments, 100 pounds of hulls were equal in feeding value to 189 pounds of corn silage. The range was from 161 to 204 pounds.

One hundred pounds of hulls were equal to 272 pounds of sorghum silage. The range was from 219 to 325 pounds.

One hundred pounds of hulls were equal to 249 pounds of sagrain silage. The range was from 210 to 276 pounds.

Johnson Grass hay and cottonseed meal were not as desirable as the other ration combinations in daily gains made or profits returned.

Bulletin No. 279 August, 1930

The Production and Storage of Sweet Potatoes

By

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Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
J. R. RICKS, Director

INTRODUCTION

For a number of years the Horticultural Department of the Mississippi A. & M. College has been conducting an experiment with the sweet potato, the purpose of which was to determine the most economical methods of production and storage. The following phases of the subject have been Studied: varieties, bedding, soils, planting, cultivation spacing effect of cutting vines on yield, fertilizers, storage, insects, and diseases.

Results were not uniform in all instances, but were such that fairly definite conclusions might be reached.

VARIETY

The question most frequently asked by potato growers, is "What is the best variety to grow?" The answer depends upon the meaning of the question—whether "best" means most suitable for certain markets, most productive, or most suited to personal tastes.

A test was made here of several varieties, the Porto Rico, the Nancy Hall, the Triumph, the Bunch Yam, the Bunch Porto Rico, and the Priestly, a strain of the Big Stem Jersey, to determine the best yielder and keeper, also to determine earliness of the different varieties. The varieties were planted in rows, one-sixtieth of an acre in each plot; all varieties were planted the same day, and given the same care. The plan was to make three plantings of each variety, but due to droughts in some years only two plantings were permitted, and sometimes only one. The first planting was usually made about May 1st, the second about May 20th, and the third, when permitted by season, about June 10th to 15th.

The only noticeable differences in potatoes produced from the three plantings were: In Bunch Yams, and in no other varieties, the yield was reduced in the second and third plantings; the three early varieties—first planting than from the second and third. Of course, the average Triumph, Nancy Hall, and Porto Rico—produced more Jumbos from the first planting than from the second and third. Of course, the average farmer does not lose these Jumbos, as he can use them for stock feed.

Porto Rico

The Porto Rico is an early, heavy producing variety, with a deep pink skin. It is the rich, yellow, juicy, yam type of potato. It produces from two to ten per cent Jumbos. Good crops can be secured from Porto Ricos when planted as late as July 10th. Here at the main Station this past season 130 bushels per acre were harvested from a plot planted on July 17th. One plot, in a rich, fertile bottom which had been used for a garden spot, equipped with irrigation pipes, and irrigated twice during the dry weather, produced at the rate of 609 bushels per acre. Some enormous potatoes were produced, weighing as much as 12 pounds. About 80 per cent of the crop was marketable. This, of course, is a very unusual yield. The average yield has been about one-half of that mentioned above. There are a number of varieties listed as Porto Ricos which are not true Porto Ricos; for instance, the Golden Beauty, the Enormous, and some of the Brazilian or Cuban varieties.

Triumph

The Triumph variety is very early, very productive, and an excellent keeper. It has a white skin, creamy white flesh of a fine texture, and

is somtimes classd as dry and mealy. Its quality, of course, depends largely upon the method of preparing for the table. It is preferred by the Northern people to our richer, jucier potato of the Porto Rico type. It has been grown in large quantities in many sections of the South and shipped to Northern markets in July and August, bringing better prices than any other varieties. This variety should be more popular in the South than it is now. It produces some Jumbos and ill-shaped potatoes. It shows up best when baked in the skin or cooked in the ashes.

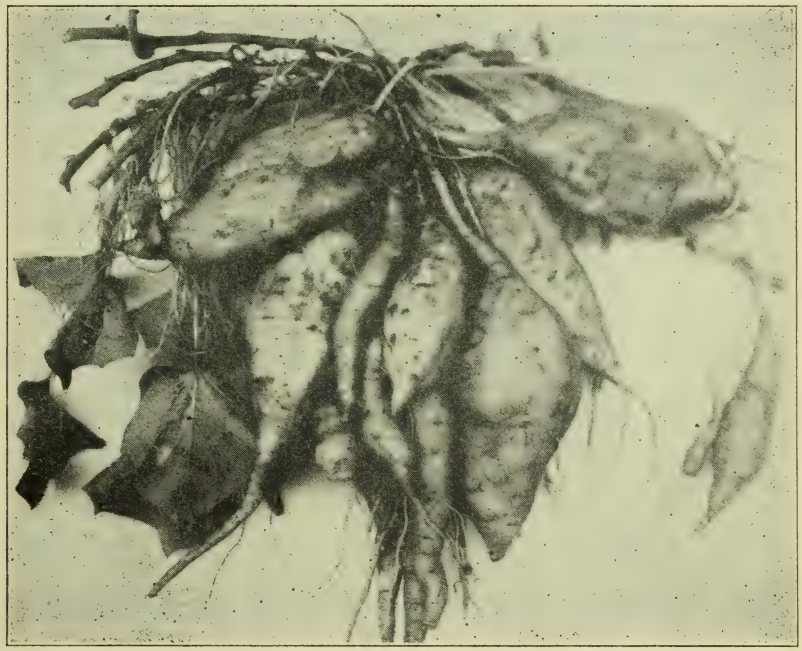

Fig. 1—A Splendid Hill of Potatoes

Nancy Hall

The Nancy Hall produces well when planted on good land—the tests here have been on land that would produce forty bushels of corn per acre —is usually very uniform in size, has very few Jumbos, and packs and shows up well on the market. It has a creamy yellow skin with tinges of pink, and a golden yellow flesh. It is a potato of fair quality, with a tendency to be stringy at the stem, and when prepared in some ways is rather dry. It has been a popular variety with growers in many sections of Mississippi, especially in the northern porton of the State, and has also been popular on the markets of the central and northern sections of the United States. It is very susceptible to diseases, especially Stem Rot and Black Rot. It is not as good a keeper as either the Porto Rico or Triumph, but keeps well in storage until the beginning of warm weather, at which time it breaks down rather quickly.

Bunch Porto Rico

The Bunch Porto Rico is a strain of the common Porto Rico, selected by Mr. Wilson of Alabama, and is known as the Wilson Bunch Porto Rico.

In some sections it has been reported as yielding well. Here, it is a medium yielder, possessing in every way the characteristics of the common Porto Rico. At this station it showed a tendency to revert back to the original Porto Rico with long vines, and was not the short, bunchy type it is claimed to be. There is no advantage of this variety over the original strain.

Priestly

This variety was tried in 1928 and a very poor stand obtained, also a very poor yield; so it is not listed in the table on yield for that year. In 1929, the stands were good, but the yield was even poorer than that of the Bunch Yams. This is a strain of the Big Stem Jersey. The quality is medium, and keeping quality is very poor. It is not recommended to Mississippi growers.

Varieties of Sweet Potatoes—5 Year Average

Year	Planting	Triumph lb per A.	P. Rico lb per A.	Nancy Hall lb per A.	Bunch Yam lb per A.	Bunch P. Rico lb per A.	Priestly lb per A.
1925:	1st	20003	18924	19473	14027		
	2nd	15438	17596	19090	4067		
	3rd	24568	19588	14027	3735		
"	Avg.	20003	18703	17530	7276		
1926:	1st	31020	30120	16620	12960	9300	
	2nd	15000	7980	9120	4740	6360	
"	Avg.	23010	19050	12870	8850	7830	
1927:	1st	12185	13423	10640	4351	14089	
1928:	1st	14460	13680	18860	10140		
	2nd	11160	12720	13800	2940		
	3rd	17760	14160	10140	2700		
"	Avg.	14468	13520	12600	5260		
1929:	1st	33120	34110	21735	4995		4230
	2nd	9190	6600	8970	4200		2880
"	Avg.	21155	20355	15353	4598		3555
5-Year Average		18164	17010	13799	6067	10959	3555
"		Bu.	Bu.	Bu.	Bu.	Bu.	Bu.
		324	304	246	108	196	63

A study of the yields of varieties for five years shows Triumph leading with an average of 20 bushels per acre more than Porto Rico, the nearest variety; 76 bushels over Nancy Hall; 216 bushels over Bunch Yam; and 261 bushels over Priestly. The average yield of Triumph for five years was 324 bushels, while Bunch Yam made just one third of the yield, an average of 108 bushels. A farmer should not make himself believe that the quality of one bushel of Bunch Yams makes up for the two additional bushels of Triumph or the 1.8 additional bushels of Porto Rico.

The 1925 report of the Holly Springs Branch Station in North Mississippi gives a five-year average in which Triumph leads with an average of 209 bushels per acre; Porto Rice follows with 197 bushels; Nancy Hall 187 bushels; and Dooley, 195 bushels. At the South Mississippi Branch Station, as given in Circular 57, a three-year average shows Porto Rico in the lead, Nancy Hall second with one strain and fourth with another, Triumph third. The results are: Porto Rico, 160 bushels; Triumph 140; Nancy Hall, high yielding strain, 155; Nancy Hall, low yielding strain, 131 bushels.

In storage Triumph showed a loss of less than 2 per cent, with Porto Rico less than 5 per cent. Nancy Hall for five months checked with Porto Rico, but after March went down in storage quickly. The Bunch Yams were poor keepers, losses often running as high as 50 per cent.

BEDDING

There are several things that must be taken into consideration in order to get good, healthy plants for setting. An important factor is the kind of bed used. There are several types: the old fashioned bed made by mixing well-rotted manure and soil and bedding late in Spring; the manure-heated hotbed; the fire-heated hotbed; and the solar-heated hotbed.

The first type is not desirable for two reasons; first, no heat is generated to warm up the tuber and cause it to sprout; second, there is danger of the development of rot in the tubers due to contact of manure with the potatoes. The potato plant does not draw on the soil for plant food, but uses the food stored up in the tuber; hence cannot make use of the manure in its sprouting.

The second method is the manure-heated hotbed. Fresh manure is used in this type of hotbed, and the heat generated by fermentation warms up the soil and causes the potato to sprout quickly. A delay in the sprouting of the potato has a tendency to make it more susceptible to rotting.

The flue-heated hotbed, as illustrated in Circular No. 65 of this Station, gives a very economical structure for production of potato plants, and its operation cost is low. A cord of wood will furnish enough heat for a bed 60 feet long and 6 feet wide. In comparison with the manure heated hotbed, this is very cheap, since 15 or 20 loads of manure would be required to furnish the same amount of heat, the manure costing several times as much as the wood.

The solar frame is a frame constructed so as to receive heat from the sun which warms up the soil from beneath and also stores up heat in water, to be released during the night., This method is cheap, the only cost being the sash. The average single sash does not cost any more than one load of manure. The sash may be used for twenty years if taken care of; the manure one season.

Potato plants big enough to be set in the field may be obtained from the hotbeds in approximately 28 days. Plants have been repeatedly taken from flue-heated hotbeds in 27 days from the time potatoes were bedded; however, comparisons show that the solar frame will produce plants just as quickly and of as good quality.

In bedding potatoes, the medium sized, smooth, sound potatoes should be used. Size of potatoes bedded has no effect on size of potatoes eventually produced, but does have an effect on number of pullings possible. For four years potatoes were grown from the smallest strings that could be selected. Another plot was planted from the largest Jumbos that could be selected. At digging time, from each plot, selections were made, the small strings from the "string" plot and the Jumbos from the "Jumbo" plot. At the end of the fourth year three disinterested parties could not tell which was the "string" plot and which the "Jumbo" plot, when the

potatoes were dug and strung out along the rows. The theory is that the bud producing the plant is just as good in the young strings as in the large Jumbos, the only difference in their suitability for bedding being that the small potatoes soon exhaust their stored food, producing only two or three pullings, while the Jumbos will produce from five to seven pullings. A grower should not hesitate to use the small sound potatoes for seed purposes if he so desires.

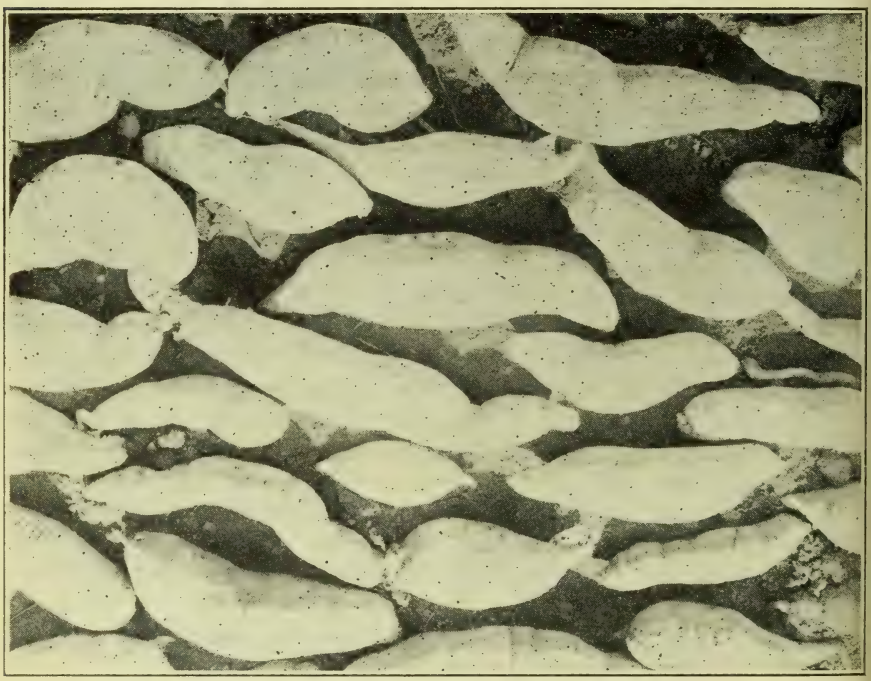

Fig. 2—Potatoes placed in bed ready for covering

The seed should be treated with one ounce of bichloride of mercury to eight gallons of water for ten minutes before bedding. The bed, when prepared, should have a layer of sand on which to place the potatoes. The potatoes should be placed on bed close together but not touching, and covered with two inches of clean sand. The sand should be obtained from a place where no washings from a potato field could have infested the soil with potato diseases.

The beds should be looked after daily and watered whenever necessary. As shown in Fig. 3, the plants should be removed from the bed when they have reached a length of three or four inches and have from three to five good leaves. A bed properly tended will produce an average of 2,000 plants from a bushel of potatos bedded. One expecting to get 2,000 plants should remove plants from the bed as soon as they are ready to go in the field in order that new plants may be produced. It will require at least three pullings, and sometimes four, from a bed planted with one bushel of potatoes to get 2,000 plants. After the first pulling the potatoes

that have been pulled out of place should be put back; and where the potatoes show any tendency to stick out of the ground or are too shallow, they should be covered as when first bedded. This going over the bed after each pulling will do much toward getting good, well rooted potato plants. When the soil is shallow, the root system is poor.

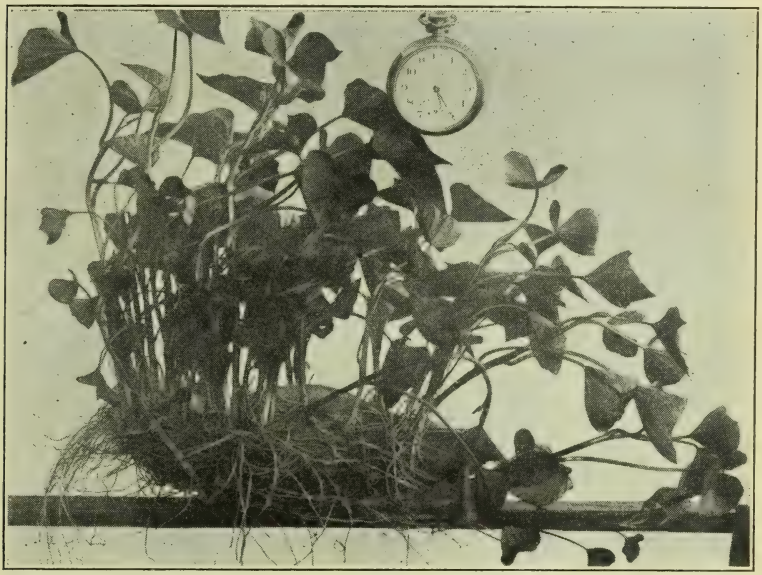

Fig. 3—A potato and a splendid bunch of plants ready for the field

SOILS

The soil for sweet potatoes should be a well drained sandy loam. Sweet potatoes do not produce well on land that is the least inclined to be wet or cold, but produces the heaviest crops on loose, well drained soil that warms up quickly. The subsoil should be preferably of good clay loam that is porous and does not hold an excess of water. The land should be thoroughly broken before rows are listed up for planting. Rows should not be listed higher than four inches. A one-horse turning plow or a middle buster may be used for this purpose. A two-by-four dragged over the rows to smooth them off is all that is necessary after they are listed. Forty-two inches is a desirable distance between rows.

PLANTING

The plants should be set approximately 15 inches apart, and with this spacing it will require about 10,000 plants to the acre. There are several mehods of setting plants. Some use the old fashioned short dibble. Its use requires unnecessary stooping, and the work is very hard. It has been found here that with an ordinary walking cane, trimmed flat on either side and notched, one can set the plants more rapidly than with the short dibble. The notch in the cane is placed across the end of the root of the plant, and the plant pushed into the ground, then dirt is packed about the

root with the cane. This method may be used only when there is a season in the soil. It has been used here for the past several years; and even with the ordinary negro labor, an average of 98 per cent stand was secured. A boy to drop the plants and a man to push them in with the cane

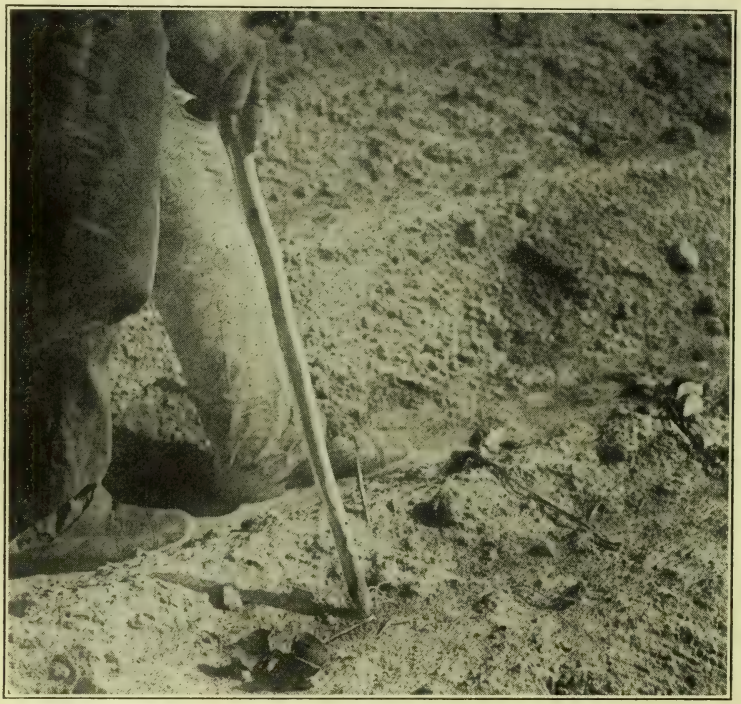

Fig. 4—The cane method of setting plants

should be able to set an acre a day, provided the plants are pulled and placed in the field for the plant setters. On lighter types of soil and where a large acrage is to be planted, a transplanting machine saves time and does satisfactory work.

As soon as the soil is dried out sufficiently after setting—which is usually done following a rain—the first cultivation should be given with a light row harrow or five-tooth cultivator of the Planet Jr. type. This cultivation areates the soil, breaks up any hard surface caused by tramping over it while it was wet, and also destroys any grass or weeds that have just begun to sprout. Sweet potatoes should be kept clean until the vines begin to spread across the rows. Two or three plowings and one good hoeing are usually sufficient cultivation for a sweet potato crop. This, however, depends upon season. In any case, enough cultivation should be given to keep all grass and weeds out of the field so that when the vines do start growing rapidly, cultivation may cease. There is no data available to show that cultivation after the vines begin to cross the rows is beneficial. At the last plowing the cultivator should be equipped with scrapes so as to clear away all grass and slightly hill the potatoes. The

eight-inch scrape furnished for a five-tooth cultivator has proven very satisfactory for cultivation because it does not cultivate deep, it destroys all grass and weeds, and slightly hills the rows, which we believe desirable.

Fig. 5—A transplant machine in use. A good implement except on stiff soils

SPACING

In order to determine the proper distance apart in rows to plant sweet potatoes, a project was started in 1925. Plots were planned with spacing of 10, 15, 25, 30 and 35 inches, and plantings were made in duplicate when season permitted. The distances were carefully marked off before plants were set. The same culture was given to all plots, and records were made of marketable potatoes.

Results of Spacing Sweet Potato Hills

Year	Plot No.	10" lb per A.	15" lb per A.	20" lb per A.	25" lb per A.	30" lb per A.	35" lb per A.
1925:	1		12656				
	2	13272	12096	13104	11200	12544	11872
"	Avg.		12376				
1926:	1	10080	12900	11400	8340	8760	5160
	2	13260	9900	9660	7260	9780	8340
"	Avg.	11670	11400	10530	7800	9270	6750
1927:	1	14560	10528	9800	10304	7056	8008
1928:	1	14220	13560	14140	12000	13440	12720
1929:	1		9840	7200	7080	6120	6060
	2		6240	5220	4260	4020	5100
	Avg.		8040	6210	5670	5070	5580
5-Year Average		13430	11181	10757	9395	9476	8986
		Bu.	Bu.	Bu.	Bu.	Bu.	Bu.
"		240	200	192	168	175	160

The records show that close spacing produces larger crops than wide spacing. The average weight of the tubers from hills spaced 10 inches apart is .37 pounds. There is an increase in the average weight of tubers as the spacing is increased, the average increase per each five inches being about .07 of a pound. As the spacing is increased the average yield of marketable potatoes is decreased, since wide spacing has a tendency to produce Jumbos, and the market demands medium sized potatoes, since there is less loss from rot, and the prices are better.

Results from five years work at the Holly Springs Branch Station show that seven inch spacing gave the greatest average yield while fourteen inch spacing gave the most economical yield,, taking into consideration the cost of extra plants and the cost of setting. The five year average in bushels per acre for this test is as follows: 7 in. spacing, 184 bu.; 14 in. spacing, 156 bu.; 21 in. spacing, 135 bu.

Fig. 6—A potato plant showing development of vines and tubers at time vines are usually cut

EFFECT OF CUTTING VINES ON YIELD OF SWEET POTATOES

It has been a common practice for many years to use vines instead of slips for late planting of sweet potatoes, and the statement is frequently made among growers that cutting the vines does not hurt the crop. A project was begun in 1923 to determine the effect of cutting vines on yield of crop. That year all vines were cut on one plot, (Fig. 7 shows 100 per cent of vines cut), half the vines were cut on another plot, and on a third check plot no vines were cut. This cutting was done as near July 1st as season would permit; and since this is a season of light rainfall, the planting was done following a rain. The latest date for this section was July 15th. At time of cutting, the vines usually reached a length of three to five feet. In 1924 and thereafter the plots were increased to five, including a check plot. In the first plot, 100 per cent was cut; in the second 75 per cent; in the third, 50 per cent; and in the fourth, 25 per cent. No

cutting was done in check plots. Digging was done in October, at the regular season, the marketable potatoes in each plot were weighed in the field, and yield per acre was caluculated.

Effect of Cutting on Quantity of Marketable Potatoes Produced

Year	Plot	100% Cut lb per A.	75% Cut lb per A.	50% Cut lb per A.	25% Cut lb per A.	None Cut lb per A.
1924:	1	3675	4557	4949	6272	5978
	2	3577	4263	5194	6958	6321
"	Avg.	3626	4410	5072	6615	6150
1925:	1	10463	17715	21693	22584	29992
	2	19735	22222	21289	23931	32582
"	Avg.	15099	19969	21491	23258	31287
1926:	1	9240	9180	7100	9640	8400
	2	8700	10980	8460	10560	11460
	3	7620	9240	10680	11400	9660
	Avg.	8520	9800	8747	10533	9840
1927:	1	10897	15439	16464	14229	18564
	2	6160	6787	6255	7005	7965
	Avg.	8529	11113	11359	10617	13264
1928:	1	15480	21160	22980	20520	23280 19500*
1929:	1	13960	17220	16620	16560	15780
	2	12060	13620	16320	16500	17220
	3	17260	14460	18000	19140	20520
	Avg.	14427	15100	16980	17400	18255
6-Year Average		10947	13592	14438	14824	17013
		Bu.	Bu.	Bu.	Bu.	Bu.
		195	243	258	265	304

*Outer check row, adjacent to buffer.

In checking the yields of the different plots for the different years it was found that cutting 25 per cent of the vines decreased the total yield of the series 2188 pounds or 39 bushels. However, in two plots in 1924, two in 1926, and one in 1929, the plots with 25 per cent of the vines cut produced more than uncut check plots. These were exceptions, since in eight plots the yield was decreased by cutting this amount of the vines.

The average yield for six years shows that cutting 50 per cent of the vines reduced the crop 2574 pounds or 46 bushels per acre. Eleven of the plots which had 50 per cent of vines cut showed a decrease in yield; two showed an increase.

The plots with 75 per cent of vines cut showed a decrease in yield of 3420 pounds or 61 bushels per acre. Only two plots showed an increase.

The plots with 100 per cent cut showed a decided decrease in yield in all plots except Plot 1 in 1926. The average yearly reduction of crop caused by cutting 100 per cent of the vines was 6115 pounds or 109 bushels per acre.

A study of the results indicates very little damage when 25 per cent of the vines are cut, since the yield is reduced only 39 bushels per acre. A farmer is justified in cutting vines for planting purposes, for the cost of plants sufficient to set two acres will exceed the value of 39 bushels of

potatoes. Sufficient vine cuttings may be secured from an acre to set two acres with less than 25 per cent of the vines being cut. If more than 50 per cent of the vines are cut, as shown in table above, the loss in crop

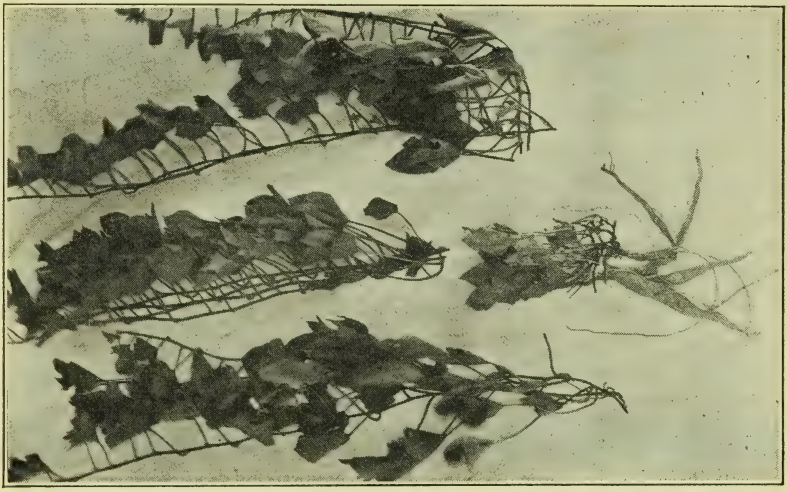

Fig. 7—Showing what is left of plant when "100 per cent of vine" is cut.

is too great. Any reduction in the vines or foliage has a tendency to reduce the crop; therefore, it may be said that the grower who has the idea that cutting vines does no harm to the crop is mistaken.

Effect of Cutting Vines on Average Weight of Potatoes

Year	Plot	100% Cut Lbs.	75% Cut Lbs.	50% Cut Lbs.	25% Cut Lbs.	None Cut Lbs.
1925:	1	.37	.64	.72	.70	.71
	2	.65	.82	.82	.85	1.08
"	Avg.	.51	.73	.78	.775	.895
1927:	1	.46	.56	.59	.51	.59
	2	.45	.59	.53	.56	.56
"	Avg.	.455	.575	.56	.535	.575
1929:	1	.50	.72	.69	.59	.68
	2	.70	.61	.76	.70	.73
"	Avg.	.60	.665	.725	.645	.705
3 Year Average		.52	.66	.69	.65	.72

Effect of Cutting Vines on Average Number Potatoes to Plot

Year	Plot	100% Cut	75% Cut	50% Cut	25% Cut	None Cut
1925:	1	542	532	589	626	816
	2	580	519	492	540	580
"	Avg.	561	425.5	540.5	583	689
1927:	1	231	272	273	273	307
	2	313	270	266	288	324
"	Avg.	272	271	269.5	280.5	315.5
1929:	1	405	314	391	463	424
	2	407	393	394	455	467
"	Avg.	406	353.5	392.5	459	445.5
3-Year Average		413	383	401	441	486

For late planting vines are more desirable than slips, as they produce a larger crop. The potatoes produced from vines are smooth and shapely, and are more desirable for seed. Growing potatoes from vines and planting on clean soil is the surest method of obtaining seed free from Black Rot.

In checking over the results to determine the effect of cutting vines on size and number of tubers, it was found that a total cutting of vines as compared with no cutting, reduced the average size of the tubers 20 per cent and the total number of potatoes 15 per cent. When 75 per cent of vines were cut, the size of tubers was reduced 6.7 per cent and the number of tubers 21 per cent. Cutting 50 per cent of the vines reduced size of tubers 3.5 per cent and the number 16 per cent. When 25 per cent of vines were cut, the size of tubers was reduced 5 per cent and the number 9.3 per cent. These results show that when 50 per cent or less vines were cut, the crop was not materially affected, either as to size of potatoes or number produced.

FERTILIZERS

Work at the main Station with fertilizers for sweet potatoes would seem to indicate that there is no profit in their use. An experiment covering two years, involving three treated plots and three check plots, was made with a complete fertilizer, applied at the rate of 300 pounds per acre. For the first year the unfertilized plots produced more than the fertilized plots; the second year, the fertilized plots showed an increase of 3 bushels per acre.

The Holly Springs Branch Station recommends that 600 pounds per acre of a complete fertilizer, analyzing 4 per cent nitrogen, 8 per cent acid phosphate, and 4 per cent potash, may be used with profit. The South Mississippi Station recommends the use of fertilizer of the same analysis, but in greater quantities, and their records show great profit from a liberal application of a complete fertilizer. Fertilizer is not recommended on the heavy soil types like those of the main Station, but is recommended on the light sandy soils of South Mississippi, and the soils of the brown loam type of central and northern Mississippi. Stable manure is not recommended as a direct fertilizer, as it causes too rank a growth of vines, and a staining of tubers. It is profitable to use stable manure on corn, and to follow the corn the second year with a crop of potatoes.

A NEW TYPE OF STORAGE HOUSE

For the past thirty years sweet potatoes have been stored in houses. The writer, in 1917, at the Alabama Experiment Station, in Bulletin No. 197 discussed at length the storage of sweet potatoes in houses as compared with banks. There have been various types of houses recommended. For the past several years experiments have been conducted here in an effort to improve on potato houses formerly recommended. The old types of houses, with stove in the curing room, were objectionable because the stove

occupied much space which might have been used for potatoes, and the curing was not uniform due to poor circulation of heat and insufficient ventilation overhead. In this type house, the temperature near the ceiling will often range from 90 to 100 degress Fahrenheit, and near the floor the temperature will be from 60 to 70 degress Fahrenheit. Potatoes cure very slowly at temperatures as low as the floor temperature mentioned above.

The main feature of the improved house which has been worked out

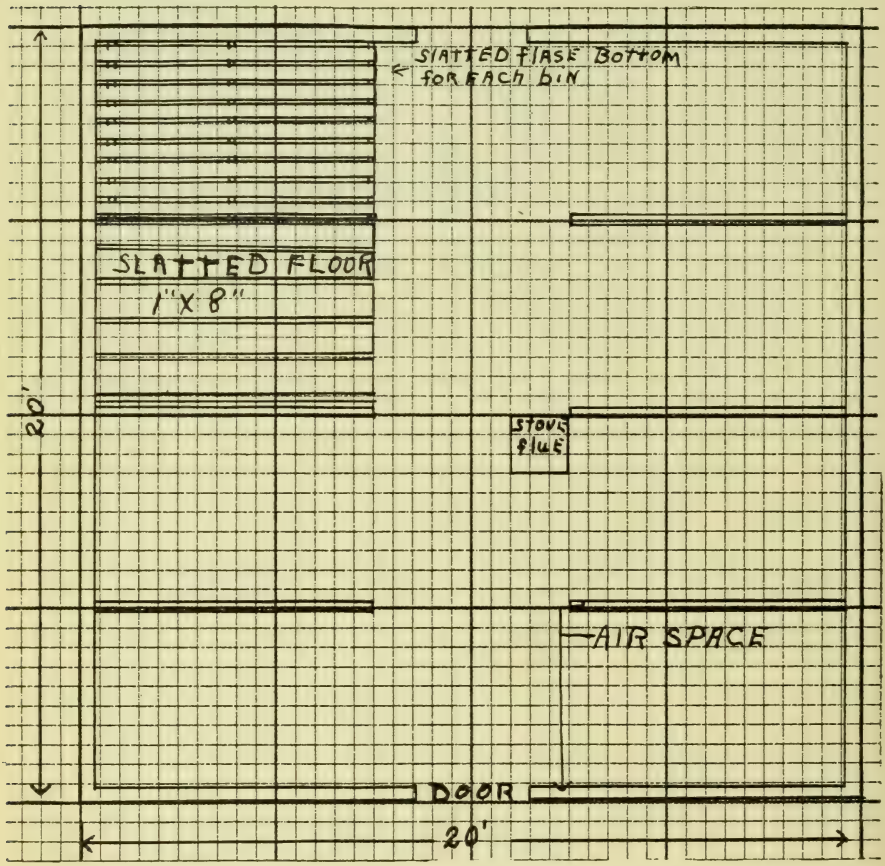

Fig. 8—Floor plan of new type house

here in basement in which the stove is placed. The basement is made with brick foundation and cement floor. This type of foundation keeps the house much warmer during the cold winter than does the house resting upon pillars. Heat from the stove, placed in the center of the basement, travels upward, passing through a slatted floor, on through the potatoes, and cures them uniformly. The chimney or flue extends up through the storage room near center of room at side of aisle. Careful tests with thermometers indicate that the temperature at the floor in the center of the

room and at the ceiling does not vary more than a degree or two, as compared with a difference of from 20 to 30 degrees when the stove is placed in the curing room.

Another change from the old type of curing house is the false or slatted floor under the bins—the floor in the aisles is tightly built. The old type of houses had a double floor. The new floor is obviously less expensive. The floor is constructed of 1½" by 8" timbers, with one inch space between. Another change is in the placing of the bins. The new idea is to place them four inches from the walls and four inches from each other. This permits air to pass between walls and bins, carrying out moisture.

In the new type of house a larger overhead ventilator is used than in the old type. Instead of the 10" by 10" ventilator, a 24" by 24" one is used, and is more satisfactory. The new type of house is more tightly built than others, and this keeps the temperature more constant than in more loosely built houses. During the past winter, which was a severe one, no fire was

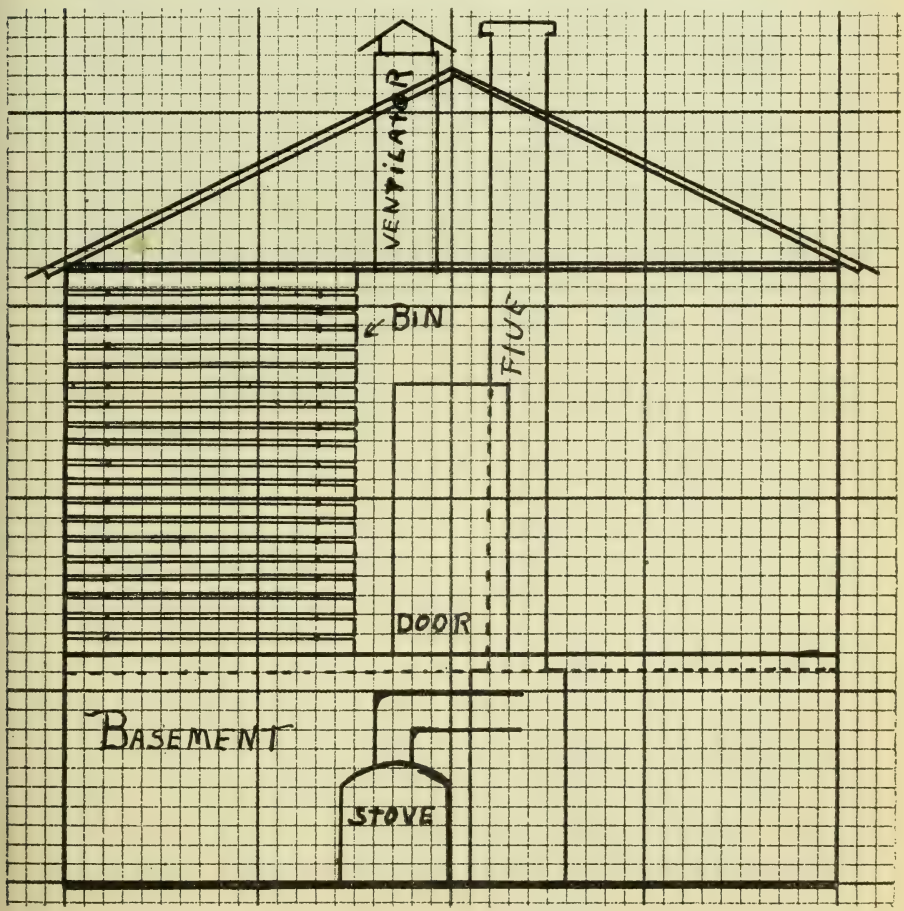

Fig. 9—End Section of new type storage house in detail

built during the entire winter, and at no time was the temperature below 50 degrees Fahrenheit. There are no windows in the new house, just a door of refrigerator type on either side, at the end of the aisles. These are kept open during curing, and create a current of air through the house, facilitating removal of excess moisture; they also make loading and unloading very convenient.

The house is built according to government plan, with tight walls and an air space between. The outside walls are of No. 1 weather boarding, lined with building paper. A four-inch air space is left, then another wall of matched boards, with building paper on it, and the paper in turn covered with a wall of tongued and grooved flooring. A house 20' by 20' should have at least four bins on either side of the aisle. Some prefer the bins a little narrower, as they think better curing is obtained thereby. Narrow bins are troublesome to fill, and it is difficult to pack and grade potatoes when getting them out for selling or other purposes. In the new type of house bins are filled to within two feet of the ceiling and good results are obtained. It is practically impossilbe to fill the bins fuller than this without having to lay them in with the hands. Unless crowded for space, it is better to leave 2½ feet of space at top of the bins.

The advantages of the new over the old type house are: The storage space in the room is about 20% greater since stove is not in the way; potatoes are subject to the same heat throughout the room; filling may be done one bin at the time or in the several bins, as is recommended for the old type of house; there is a minimum loss in the new type of house provided potatoes are properly handled when placed in storage. The basement may be used for storage. Hampers may be removed from the curing room above to the basement after being cured, and will keep as if in the curing room; however, curing in the basement is subject to all the disadvantages of the old style house with stove in curing room.

REMOVING VINES AT DIGGING TIME

The problem of removing vines at digging time has been a source of worry to growers. A very satisfactory cutter for removing vines is described in Circular 84 of the Mississippi Experiment Station. This cutter is made by nailing two pieces of 2" by 4" timber together in box fashion to form the runners of a sled. There are two such runners with boards nailed on the top of these, as shown in Fig. 10, with mowing machine sections on the edge of the 2" by 4" pieces, as shown in the same figure. The mowing machine sections should not extend further past the wood than one inch, so as not to cut the potatoes. The cutter should be 12 inches narrower than the rows, that is, a 42 inch row should have a 30 inch cutter (measured from outside to outside). This implement is too light to cut vines by being pulled along the middle, but does splendid work when 100 pounds of weight are placed on it. A fifteen year old boy, for the weight and driver,

and a mule to pull this cutter, can cut vines and keep ahead of a buster plowing up the potatoes. This cutter was used for the past two years and found very satisfactory.

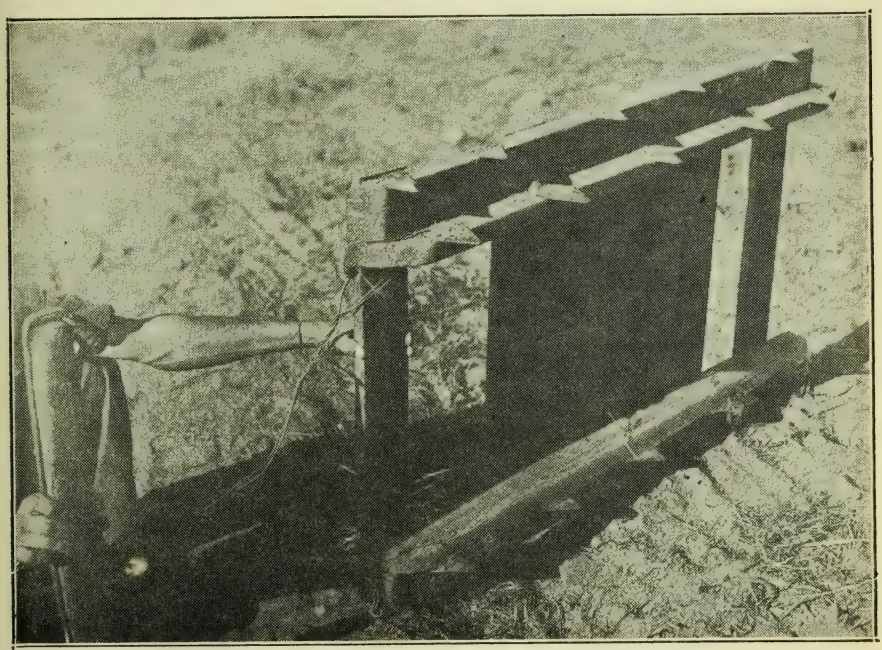

Fig. 10—Under view of the vine cutter, showing position of the mowing machine sections, the sled runners, and how the two by fours are put together

HARVESTING AND STORAGE

Sweet potatoes should be dug before any frost damages the foliage. In work done at the Alabama Experiment Station, published in Bulletin No. 220, it was found that any damage by frost to the foliage injures the keeping quality of the potatoes. This damage is caused by the frost bitten sap being carried down to the potato, causing souring or fermentation, which in turn causes the potato to break down in storage. Frost bitten potatoes are dangerous as food for man or stock.

There is usually a warm, dry period in early October that is ideal weather for digging and curing, either for storing in house or in bank. A killing frost usually follows this warm period of weather and the frost is followed by heavy rains, which are very great obstacles to digging and curing potatoes; therefore, it is best to get digging done during the warm, dry period. When potatoes are dried immediately after being taken from the ground, all of the cut and bruised places callous over. If the potato remains full of water, the soft rot, molds, or dry rot soon start decay, often causing heavy losses. The diseases spread from the decaying potatoes to the sound ones.

If bank storage is used, the potatoes should be put into a heap where they are to be banked, covered with hay or straw during the nights (pine

straw is the most satisfactory), uncovered during the day, and allowed to cure in the sun. After a period of a week, they may be covered about a foot thick with pine straw and banked with about ten inches of soil. A place should be left for ventilation at top of bank, and some kind of shelter put over the bank. This method is expensive from the labor standpoint, but potatoes have been kept quite well this way.

A fire is built in the storage house the same day digging is begun. The house is warmed to a temperature of approximately 85 degrees Fahrenheit and kept between 80 and 90 degress for eight days, with doors and ventilator open. When the potatoes are cured, they will have a slightly spongy feeling. If weather conditions are right, curing may be done in less than eight days. If it is cold and rainy following digging, it may take a longer period of time. It is best to judge by the condition of the potatoes. After curing is done, if the weather is cold and rainy, it is best to close the house; if the weather is warm, it is best to leave the doors open for a few days; as sometimes when firing is stopped, there is a tendency for the moisture to settle around the potatoes and cause sweating. Circulation of air through the building will prevent this. After curing is done,

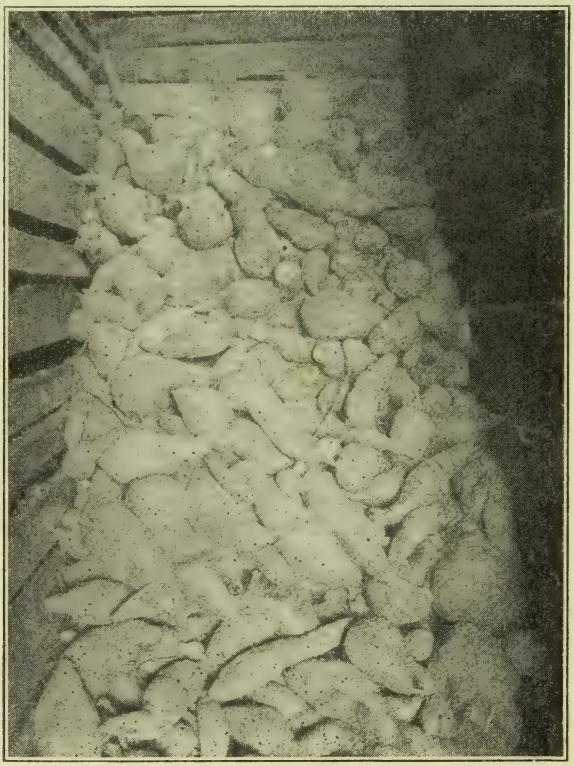

Fig. 11—A bin of potatoes at end of seven months' storage

the temperature should be kept between 50 and 60 degrees throughout the storage period, as nearly as possible. If there is a tendency at any time for mold to appear on the potatoes, this may be stopped by thorough ven-

tilation on warm, sunshiny days. Unless there is danger of freezing. there is no need for further fire.

All badly bruised and cut potatoes, and all strings, should be sorted before being placed in the house. These may be stored separately and used for stock feed or immediate consumption, but should not be mixed in with sound marketable potatoes as they will often start and spread decay in them. The potatoes are placed in hampers or crates and these containers are put in the bins. The potatoes are brought to the storage house each day as they are dug.

SWEET POTATO INSECTS

There are but few insects which attack the sweet potato, and only one that could be considered serious. This is the sweet potato weevil, a slender, ant-like beetle with a long snout. This insect restricts itself to sweet potatoes and related crops, causing damage by boring into the tubers.

It is controlled by destroying all vines and tubers of the infested field and all related plants in the vicinity. The marketable potatoes should be disposed of early and the vines and tubers that are not marketable fed to stock. The crop for the next season should be from clean potatoes and as far away from the infested field as posible. All storage banks, houses, and plant beds should be thoroughly clean in order to eradicate this pest. Further information on the sweet potato weevil may be had from the State Entomologist, A. & M. College, Mississippi.

SWEET POTATO DISEASES

Stem Rot—This disease attacks the stems of the potato at or near the surface of the soil, causing foliage to turn yellow and vines to cease growing. The next stage is a wilting of the plant. If the bark is peeled back on the stem at the surface of the ground, a blackening of the inner stem is noticeable. To control, destroy diseased plants, select seed from healthy hills, and plant on new land.

Mosaic—This trouble is recognized by a dwarfing of plants and leaves. also by unusual curled, crimped form of the leaves, with numerous fine, whitish lines forming a mottled contrast to a normal leaf. This disease has been noticed several times in the Nancy Hall variety. To control, destroy all suspicious plants, and select seed from healthy hills.

Black Rot—This disease occurs in both field and storage house. It is recognized by the black spots of circular nature that extend deep into the potato. It is noticed occasionally in the field, but is easily seen in the storage house, where it spreads rapidly, causing heavy losses. To control, plant vine cuttings on clean soil, and spray storage house thoroughly with Bordeaux mixture.

Soft Rot—This is a soft, brownish rot that occurs usually when storage is begun. Very little trouble is experienced with this disease if proper curing is done.

Charcoal Rot—This is a storage trouble that occurs in overcrowded or over heated storage houses—frequently occurring in bins next the stove. This disease is sometimes mistaken for Black Rot, but may be distinguished from Black Rot in that it does not produce surface spots, but turns the interior of the potato into a black charcoal mass that destroys the potato. Black Rot, on the contrary, develops rot spots on the surface and does not, as a rule destroy the potato.

Dry Rot—This is a form of rot that begins at the broken end of a potato or in bruises or cuts. It works slowly, producing a grayish brown firm type of rot. It is frequently found in storage, but is never considered serious.

Other diseases occur in the sweet potato but are not considered serious. Full information on potato diseases may be had from the Plant Pathologist, A. & M. College.

SUMMARY

The Triumph variety has proven the best yielder and the best keeper. Porto Rico is the second best yielder and keeper, and is gaining in popularity over other varieties. Nancy Hall is third in yield and keeping quality, and is the most susceptible to disease. Bunch Yams are not profitable as compared to other varieties.

Fifteen inches is the most satisfactory distance to space potato plants when cost of plants and production are considered.

Heavy cutting of vines is not economical; both size and number of tubers are reduced. Less than 25% of vines may be cut and used for planting with profit.

A storage house with heat in the basement has been found most desirable for curing and storage.

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Bulletin No. 280 August, 1930

Propagation Studies With The Southern Blueberry

By

L. M. WARE, Horticulturist

Success in the rooting of blueberry cuttings depends primarily on the season made.

Mississippi Agricultural Experiment Station

A. and M. College, Mississippi

J. R. Ricks, Director

FOREWORD

In various sections of the United States today commercial plantings of blueberries are being established. In the South such plantings are to be found in the southern part of Mississippi, Alabama, and Georgia, and in the northwest part of Florida. These early plantings were made by random digging of native plants, with no effort toward selection; and as time has passed and plantings have increased, there has been no change in the early method of establishing these plantings or in the type of plants used. The continued establishment of plantings in this fashion in the South has been due, first, to the precedent established by the very first plantings made; second, to the failure on the part of the grower to recognize the insecure status of an industry thus established; third, to the pure exploitation by land agents of uninformed investors; fourth, to the fact that the industry was established before varieties were known or the value of varieties recognized; fifth, to the impatience of growers in their effort to establish large plantings at one time, rather than lose years in patient selection; and sixth, to the absence even though superior varieties were known, of a rapid and successful method of propagation.

A change from the present methods will require, first, the awaking of growers to the need of establishing solid plantings of standard varieties possessing superior characteristics on exactly the same basis that every other fruit is established; second, the patient search in established plantings and in native groups for superior berries worthy of being given variety names and being commercially propagated, or patient hybridization and selection of promising hybrids from crosses between the Southern blueberry and those species with which it will cross; third, the development of a rapid and certain method of asexual propagation, economical of propagation material and propagation space, which will permit unlimited multiplication in a short while of those selections that may be found or developed, and which posses distinctly superior characteristics; and fourth, multiplication of these berries in commercial quantities.

Anyone who has ever visited commercial blueberry plantings in the South has been impressed with the endless variety of types to be found; however probably not more than one in ten thousand or even one hundred thousand has characteristics that would justify its separation, naming, and propagation as a commercial variety; yet, there are a few berries that have been found that do possess such excellent characteristics that they are worthy of a place as a commercial variety, and with little doubt others could be found by patient search. Longley (18) and Coville (8) have recently expressed the hope that hybridization may be possible by crossing the Southern blueberry (Vaccinium virgatum) with a promising blueberry (Vaccinium pallidum) native to the mountains of North Carolina and Tennessee, having the same number of chromosomes. There are then these two methods of improving the Southern blueberry. Both will require years of patient efforts before commercial quantities are produced, yet this seemingly slow method is the only way by which the blueberry industry in the South can hope to establish itself on a secure footing. The Bureau of Plant Industry, several state experiment stations, and a few long visioned individuals are carefully and patiently searching for berries that meet the specifications of the market. These efforts in time will bring results. Once superior berries are produced or found, then their multiplication in commercial quantities depends upon finding a rapid and certain method of propagation.

Propagation Studies with the Southern Blueberry

By

L. M. WARE, Horticulturist

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PROPAGATION STUDIES WITH THE SOUTHERN BLUEBERRY

This publication is concerned only with that phase of blueberry culture dealing with propagation.

It is the purpose of Part I to outline briefly the present status of blueberry propagation in the United States and to summarize the experience in the past of investigators in their efforts to work out a successful method.

It is the purpose of Part II to give experimental data showing the existence of a strong and apparently inherent seasonal periodicity of rooting of blueberry cuttings, with the possibility of using this fact in the commercial propagation of this fruit, and also giving experimental comparisons of rooting of cuttings in various kinds of propagating media, with different amounts of shade, ventilation, and leaf area, and by the use of various types of cuttings placed in different types of frames.

It is the purpose of Part III to give detailed instructions on suggested methods in the propagation of the Southern blueberry.

Part I—GENERAL SURVEY

Present Status of Blueberry Propagation

A survey of the blueberry industry in the various sections of the United States adapted to the growing of either the Northern or Southern species of blueberry indicates that there is not a single section today where rapid expansion of a possible industry at this stage does not await the development of a satisfactory method of asexual propagation which will permit a rapid means of multiplying those varieties or selections which possess superior characteristics. Munson (20) of Maine, in 1901 stated, "The one chief drawback to the dissemination of the blueberry has been the difficulty of propagation." Card, (4) of Rhode Island, in 1903 stated, "One of the chief hindrances of its spread in cultivation has been in the difficulty experienced in propagation." Beckwith and Coville (1) of New Jersey, in 1927 stated, "The propagation of the blueberry is the one big factor holding back plantings in New Jersey." Crowley, (10) of Washington, in 1926, stated that one of the chief reasons for the slow development of the industry in that state had been the comparatively high price of the plants. "This", he said, "is due to the fact that they are so difficult to propagate." Johnson (17) of the South Haven, Michigan, substation, in May of 1930 stated, "Though considerable information has been published concerning methods of propagation, the high bush blueberry is still considered so difficult to propagate that the price of plants remains too high

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Munson, (20), states that there are 125 species of blueberries described, that 25 are native to North America proper, and that 25 more species are native to Central America and Mexico. The important blueberry of the South is Vaccinium virgatum, and of North, Vaccinium corymbosum. These two species are those to which references are made in this publication.

to permit rapid development of a cultivated blueberry industry." These statements only emphasize the difficult problem presented in the propagation of the blueberry and the need of finding some way by which it can be successfully propagated.

Objections to Various Methods Now Generally Used

There are serious disadvantages to each of the vegetative methods commonly employed today. Propagation by suckers is an easy method, but too slow ever to solve the problem of supplying plants on a commercial scale, certainly until a reasonable acreage has been established. This is also true of stumping and division. Tubering, as described by Coville, (7) is fairly certain, but too costly and extravagant of materials and of propagation space. Plants from seed do not come true to the parent plant, so there is no advantage of seedlings over random digging of forest plants. Grafting or budding cannot be used in practice because of the suckering habit of the plant. Grafting, however, on established plants of selected individuals may be used as a means of quickly multiplying a small quantity of propagation wood to the point where its use later as cuttings may be made for permanent planting. It would seem that of the various ways by which propagation may be practiced cuttings offer the most rapid multiplication, if a sure method can be worked out.

Past Experience in Efforts to Propagate the Blueberry by Cuttings

Unfortunately, propagation of cuttings has not been successful, in fact, it has generally resulted in complete failure or in a very low percentage of rooted plants. A review of literature, references to which are contained in The Agricultural Index and in The Experiment Station Record from 1900 to 1929 inclusive, reveals only one investigator whose success in the propagation of the blueberry by the use of cuttings promises that this method is certain or rapid enough to produce commercial quantities of plants from a small initial supply of material such as necessarily will be true with recently developed varieties, and this has come only in the last two years and has been confined to Northern species of the blueberry. Fuller, (13) in 1887, gave directions for growing seedlings. He did not mention propagation by cuttings. Card, (4) (5), in 1898, made root and stem cuttings in December of the blueberry, placing them in the greenhouse. By the following May sixteen were yet alive, but only two had produced a feeble supply of roots. He concluded that both stem cuttings and root cuttings send out shoots readily, but it seems to be with the greatest difficulty that they produce roots. Munson, (20), in 1901 says "Grafting is easily performed", but adds, "the propagation of seedlings and division are more generally used." Coville, (7), in 1921, whose careful studies of the blueberry have contributed more than any other one investigator's to an understanding of the requirements of the plant in

general, as well as to the specific requirements for successful propagation, describes in detail six methods of propagation. He does not give, however, quantitative data sufficient to enable one to determine the success of each method, the rate of multiplication, and the probable percentage that successfully produced new plants by the different methods. He discussess very fully propagation by dormant hardwood stem cuttings and root cuttings. He mentions the use of greenwood cuttings and predicts failure from their use in these words, "The rooting of leafy cuttings of the blueberry in summer is difficult because at a temperature of about 70° F. the cuttings usually blacken and die." There is no further consideration of this method. In the Oregon Biennial Report of 1927-28, (25), the statement occurs that attempts to propagate the blueberry by cuttings have been generally unsuccessful. Mowry and Camp, (19), in 1928 describe several methods of propagation most generally used. They state in regard to cuttings that a low percentage generally root. They used hardwood cuttings, one year old, made during the dormant season.

Hope Offered in Recent Investigations.

Johnson, (17), in a publication issued in May, 1930, gives for the first time sufficient quantitative data in the results of propagation studies with blueberry cuttings to lead one to feel that a method has been worked out which offers a practical, rapid, and certain method of propagation of the buleberry. His studies were with the Northern species. He used greenwood cuttings made in July and placed in especially designed solar frames or in enclosed frames. After two years of experimental work with the propagation of the Southern blueberry, results at the Mississippi Experiment Station justify the belief that a method has been worked out which satisfies the requirement of a practical method of propagating the Southern blueberry. This method is based on the discovery of one fundamental tendency, seemingly inherent in the blueberry and apparently overlooked by other investigators in timing the period of progation. This may be summed up by saying that the blueberry has a strong seasonal periodicity of rooting confined at this latitude to the period between April 20th and May 20th. Coville, (7), in his close studies of the blueberry, had previously noted a cyclic occurrence of certain activities regarding top growth followed by root growth, and then by secondary top growth, followed in turn by a second growth of the roots; but he had apparently overlooked the possibility of so timing his propagation period as to take advantage of this cycle in the rooting of the plant. Experimental evidence of this periodicity with other comparisons and detailed descriptions of suggested methods are given in Part II and III. Incidentally, the method makes use of greenwood cuttings, the use of which is discouraged by Coville, but made use of by Johnson in the Propagation of the Northern blueberry.

Part II—EXPERIMENTAL STUDIES ON BLUEBERRY ROOTING

The more or less complete failure of propagators in their effort to discover a practical method of rooting the blueberry gave one, in starting out to find a solution to this problem, little indication of the direction efforts should take. This made necessary in the beginning a rather broad outline in an effort to find some promising lead. The earlier studies with later modification included comparison of rooting of different types of cuttings, made at different seasons, placed in different types of media, given different amounts of botom heat, different degrees of shade and humidity, and different amounts of leaf area.

Standard Procedure

Previous observation had revealed wide differences in the ease of rooting different individual blueberry plants. All early comparisons were made only from cuttings taken from a single plant. The necessity of having more material for later studies required the taking of cuttings from ten or more plants. These were always made into cuttings and divided equally into the number of lots required. The standard treatment of cuttings, where some of these factors were not introduced as variables, consisted of simple types of dormant cuttings during the winter, of greenwood cuttings during the summer, with all leaves removed from the dormant cuttings, two leaves left on the greenwood cuttings, humidity controlled by glass sash, shade furnished by slat frames supplemented by brown paper during the five hours of maximum heat during the summer months, daily watering or inspection to determine need for water, and a propagating medium composed of a 50% mixture of German peat and sand.

Seasonal Periodicity of Rooting

Observations made at an earlier date based on thousands of records made from some 50 species of ornamental shrubs, cuttings of which were taken at different seasons of the year, showed a strong tendency of some species to root much more satisfactorily at certain seasons than at others. There was the possibility that the blueberry would show this tendency. For two years cuttings have been made each month to determine this one point.

The data in Tables 1 and 2 show an extremely strong seasonal periodicity of rooting in the blueberry, the successful period of rooting being confined, where a peat-sand mixture is used, to late April and May for this section, and extending, where sand is used, into June, with a minor period of successful rooting in September. There is the suggestion from the results secured in a pure sand medium that factors other than an inherent seasonal periodicity may be operative, or that certain factors cut short the possible duration of this period where a peat mixture is used. The first year's

Table 1. The Influence of the Season of Propagation on the Rooting of Cuttings.
(All types of cuttings included)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1929				Sash propagating house—½ peat-sand mixture								
Rooted	6%	18%	18%	83%	28%	3%	.8%	0	46%	15%	36%	19%
No. Cuttings	181	28	28	341	152	235	1060	—	59	118	136	233
1930												
Rooted	4%	7%	7%	86%	77%	20%	15%*					
No. Cuttings	76	27	27	136	1558	326	253					
1929				Solar frame—½ peat-sand mixture.				1928				
Rooted	18%	18%	22%	82%	19%***	11%***	0	0	42%	26%	19%	13.5%
No. Cuttings	186	186	69	227	171	54	0	0	79	88	106	266
1929				Sash propagating house—sand medium.								
Rooted				17%	66%	70%	16%	0	26%	16%		
No. Cuttings				92	209	145	398	—	212	55		

*Probable.
**See Table 2 for rooting at different periods within the month.
***Sashes removed below. No solar heat beneath after June.

Table 2. Rooting Within the Favorable Season.
Sash propagating house—½ peat—Records taken July 28.

Date Made	Cuttings Rooted or Active at base		Cuttings dead or Black at Base		Cuttings Tops Alive		Cuttings Probably Rooting		Total No. Cuttings in Record
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	
April 21	117	86.0	13	9.5	133	90.4	117	86.0	136
May 5	317	92.9	18	5.2	323	94.7	317	92.9	341
May 12	161	68.2	75	31.8	187	79.2	161	68.2	236
May 31	308	56.2	240	43.8	402	75.1	308	56.2	548
June 19	65	19.9*	221	67.7*	164	50.0	85	26.1*	326

*Records not final.

observations indicated a definite seasonal periodicity and gave the first real hopeful lead to the solution of the problem. It was, naturally, a matter of much concern to see if the second year would repeat the results of the first. It was also a matter of much practical value to determine within this successful period more exactly the limits of the period and the percentage rooting at the different intervals within the period. The records in 1930 have duplicated those of 1929, substantiating the belief that there is a strong seasonal periodicity of rooting. These records have shown that it is possible to root successfully the Southern blueberry if the cuttings are made at the right time, using greenwood cuttings with two full leaves, and with proper regulation of shade and control of humidity. These results strongly indicate that the general failure in the rooting of Southern blueberries up to the present

Fig. 1. Root development of cuttings made at different seasons. No. 40 made April 15; No. 67, June 15; No. 70, July 12; No. 94, July 28; No. 96, September 3; No. 98, October 4; No. 102, December 9; No. 107, March 20. Photographed May 5.

time has been due to the use of the wrong type of cutting—the dormant hardwood cutting—and to the making of these at the wrong season of the year—during the dormant season.

Table 2 shows a rather definite period where rooting is best within the optimum rooting period. The optimum period of rooting at this latitude in 1930 was May 5th. Before and after this period the per cent rooting dropped off. The last week of April and the first week in May is the general period of optimum rooting. Where large numbers of cuttings are made the possible period of satisfactory rooting extends from April 15 to May 20.

Having been satisfied, after the first year's results were secured, that successful rooting of the blueberry was a matter of the proper season of propagation, the many comparisons made and studies reported in the remaining portion of this bulletin were made with an idea of determining within the proper season the best combination of conditions which make for optimum rooting.

Fig. 2. Root development of cuttings made at different dates. No. 1 made November 6; No. 2, December 9; No. 3, March 20; No. 4, April 21; No. 5, May 5; No. 6, May 17; No. 7, May 31; No. 8, June 19; No. 9, July 2. Photographed July 15.

The Value of Various Types of Cuttings in the Propagation of the Blueberry

Small shoots, shoots of moderate vigor and very vigorous shoots may be found on the same plant. These may be made into cuttings in various ways. It was of practical worth to know the relative value of these types. In this study eight types of cuttings have been studied. These consisted of cuttings made from the base, middle, and tip portion of very vigorous shoots, from the base and tip portion of moderately vigorous shoots, and from simple, heel and mallet cuttings of small shoots. Figures 3 and 4 show each of the types of cuttings used.

A study of Tables 3 and 4, as well as general observations on the behavior of cuttings in many lots not reported in this publication, shows that the small cuttings from non-vigorous shoots make one of the most satisfactory types of cutting. They have consistently given a higher percentage of rooted cuttings, have developed a good root system, and secondary growth following rooting has compared favorably with that made from other types. This is of considerable importance since these small shoots consitute a prolific source of propagating material. On a large plant

Table 3. Comparison of Various Types of Greenwood Cuttings.
Sash Propagating house—½ peat—Records made July 28.

Type of Cutting, and Date Made	No. Cuttings	Per Cent Rooted	Avg. No. Main Roots per Cutting	Avg. Total Lgth. Main Roots per Cutting	Avg. Total No. Lateral Roots	Calc. Avg. Total Lgth. Roots	Lgth. Sec'd'y Top Growth	Per Cent Making Secondary Top Growth
May 12, 1930								
Base of vig.	28	27	2.12	2.46	15.74	10.62	.84	15
Middle of vig.	28	55	3.57	3.83	17.42	15.71	1.53	35
Tip of vig.	22	50	5.45	2.97	9.81	14.72	.11	4
Base of mod.	29	56	4.36	4.79	18.67	17.95	1.59	47
Tip of mod.	32	60	3.23	3.80	12.01	14.26	.57	30
Small	23	86	3.15	3.27	6.15	7.53	1.43	33
May 31, 1930								
Base of vig.	75	53	2.90	3.21	9.57	9.97	.72	32
Middle of vig.	76	54	4.10	4.50	10.75	11.50	.45	20
Tip of vig.	67	40	2.16	2.44	5.68	6.90	.11	9
Base of mod.	59	50	2.89	2.70	5.38	6.70	.16	8.5
Tip of mod.	53	41	2.06	2.20	3.60	4.06	0	2
Small	73	55	2.60	2.43	7.24	8.50	.28	10

Table 4. Comparison of Rooting in Simple and Mallet Cuttings at the Different Seasons.
½ Peat—Season, 1929

		April 15		May 16		June 28		July 12		Sept. 3	
Type of Cutting	Type of Frame	No. Cut'gs.	Rooted	No. Cut'gs.	Rooted	No. Cut'gs.	Rooted	No. Cut'gs.	Rooted	No. Cut'gs.	Rooted
Mallet	Slat Prop. House	142	81%	50	20%	315	1.3%	15	0	18	62%
Simple	Slat Prop. House	95	91%	48	23%	120	2.3%	25	0	28	43%
Mallet	Solar	51	90%	73%	27%	127	0				
Simple	Solar	131	85%	98	13%	46	13 %				

two thousand such cuttings can be made at one time without seriously reducing in future years the production of similar wood from a valuable selection or from a select hybrid. This is in marked contrast to the number of cuttings possible from tubering,

Fig. 3. Types of shoots showing cuttings made from each portion. Above, vigorous shoot; below, moderately vigorous shoot.

stumping, or similar methods requiring large amounts of propagating material, and to the ultimate damage to the plant itself and to its future production of propagation wood resulting from such drastic treatment required by these methods. A larger per cent of cuttings from the more vigorous shoots die than from the less vigorous; however, they may be used, and where they do root, they develop a good root system generally larger than the smaller cuttings, with secondary top growth that is vigorous. The middle portion of vigorous shoots and the basal portion of moderately vigorous shoots make fairly good propagating material. (See Fig. 5.) It would seem that cutting back of the vigorous shoots on the parent plant to one-half their length, especially in April and May, seems advisable, giving satisfactory propagation material from the middle and tip portions, and also making provision for a renewed supply of less vigorous shoots another year from the branches which arise in a short while below the cut. Cuttings from moderately vigorous shoots make satisfactory propagating material, although they have not given generally as large a per cent of rooted cuttings as the smaller type. There is very little difference in

the rooting of the various types of dormant cuttings, but no type roots very satisfactorily during the dormant period. One is impressed with the ease with which any type roots within the general period of optimum rooting, and of the difficulty with which any type roots outside of this period. Cuttings from vigorous

Fig. 4. Different methods of preparing small cuttings.
No. 1, mallet; No. 2, simple, No. 3, two leaves; No. 4, one leaf; No. 5, one-half of two leaves.

shoots reach their best period of rooting later than those from less vigorous shoots, indicating a periodicity that may be, at least partly localized in the shoot itself rather than entirely determined by the general periodicity of the plant. There is very little consistent difference in the value of a simple, mallet, or heel cutting. All are entirely satisfactory, although the simple should probably be used more generally.

The Influence of Temperature on Rooting

In view of the statement by Coville that above a temperature of 70° F. cuttings of the Northern blueberry turn black at the base and die, it was of considerable importance to determine the influence of temperature on rooting in the Southern blueberry. Observations and records have been made for two years in an effort to determine what temperatures are most favorable to the rooting

Table 5. Comparison of Root Development and Top Growth in Simple, Heel, and Mallet Cuttings. Records made July 26, 1930. Cuttings made April 21—½ Peat—Slat propagating house—Season 1930.

Type of Cutting	No. Cuttings	Per Cent Rooted	Avg. No. Main Roots Per Cutting	Avg. Length Main Roots In.	Avg. No. lateral Roots	Avg. Total Length of All Roots per Cutting In.	Average Secondary Top Growth In.
Simple	34	73	3.80	9.77	31.60	30.42	.74
Mallet	29	62	5.00	8.94	38.61	38.11	.74
Heel pulled out	24	58	5.30	9.17	39.63	42.00	1.53

Table 6. Relation Between Temperature and Rooting in the Southern Blueberry. (A) Avg. of daily maxima. (B) Absolute maximum for the week.

Date Made	Type Frame	Type Media	Per Cent Cut'gs. Rooted	Temp. for 7 weeks following insertion of cuttings													
				1st wk.		2nd wk.		3rd wk.		4th wk.		5th wk.		6th wk.		7th wk.	
				A	B	A	B	A	B	A	B	A	B	A	B	A	B
1929	Slat House	½ Peat															
1/30	"	"	6	62 *													
Feb.	"	"	16	62 *													
3/8	"	"	18									77 *					
4/15	"	"	83	77 *								80 *					
5/16	"	"	28	80 *								82 *					
6/15	"	"	3	82 *								87.2	90	84	88	88 *	
7/28	"	"	.8	87	89	85	86	82.8	88								
8/20	"	"	0	82.8	88									73.6	80		
9/3	"	"	46							73.6	80						

10/2	"	"	15	74				75.7	78	71.1	76	64.3	68	71.4	76	65.1	71	
11/8	"	"	36	65.1	71			62.5	68	64	72	68	72	72.1	81			
12/14	"	"	19	72.1	81											63.5	68	
1930																		
1/31	"	"	4	63.5	68	71.8	76	64	74					67.2	74	63.4	72	
2/1	"	"	7			71.8	76	64	74					67.2	74	63.4	72	
3/20	"	"	7	69.7	76	61.1	65	74.2	81	74.1	78	75	77	72.1	79	80	83	
4/21	"	"	86	72.1	79	80	83	79.2	86	79.1	86			74.1	84	83.7	87	
5/5	"	"	93	79.2	86	79.1	86			74.1	84	83.7	87	82.7	86	89.2	94	
5/12	"	"	68	79.1	86	74.1	84	83.7	87	82.7	86	89.2	94	92.8	97	88.5	92	
5/31	"	"	56	74.1	84	83.7	87	82.7	86	89.2	94	92.8	97	88.5	92	95.2	98	
6/19	"	"	26	89.2	94	92.8	97	88.5	92	95.2	98	87.1	91	89.7	93			
1929	Solar	"																
1/30	"	"	18	55 *														
Feb.	"	"	18															
3/8	"	"	22											87 *		85 *	96*	
4/15	"	"	82	87 *		85 *		85.8*	89*	83.5*	92*	90 *						
5/16	"	"	19	90 *								92 *						
6/15	"	"	11	92 *								84 *				87 *		
7/12	"	"	0									90	98	88	92	85.6	88	
8/10	"	"	0	90	98	88	92	85.6	88			81.4	83					
9/3	"	"	42	81 *		81.4	83			78 *		77.8	83	83.3*	86*	79.7	82	
1930																		
5/5	"	"	95.4	87.1	96	87.1	102	97	104	102	108	102	107	97.4	103	105	108	
6/19	"	"	1.5	102	108	102	107	97.4	103	105	108	97	100	100	104			
1930	Cold Frame																	
5/5	"	"	94.4	84.2*		84.1*				77.0*		88.7*		87.7*		94.2*		
5/12	"	"	96.5	84.1*		76.1*		88.7*		87.0*		94.2*		97.8*		93.5*		
6/19	"	"	54.2	94.2*		97.8*		93.5*		100.2*		92.2*		94.7*				

*Records taken from maximum-minimum thermometer, not always complete for each week. Other records taken from soil-air thermograph.

of the blueberry within its best rooting period, and what temperatures in the benches might be considered as sufficiently high to cause death of the cuttings. Temperature records reported in Table 6 for the period after August 1, 1929, were taken from the records of combination soil-air thermographs, one located in the solar frame, and one located in the slat propagation house. Temperature records during the Fall of 1928 and the Spring of 1929 were secured by the use of a maximum-minimum thermometer.

Fig. 5. Root development and secondary top growth in different types of cuttings.
Upper row: Left, base of vigorous; center, middle of vigorous; and right, tip of vigorous.
Lower row: Left, base of moderately vigorous; and right, tip of moderately vigorous. Cuttings made May 12. Photographed July 15.

There is no continuous record over this earlier period, but sufficient records are given to indicate in general the temperatures reached.

A general conclusion drawn from data which were available after the first full year's work was completed led us to believe that the Southern Bluberry rooted best at a temperature in the propagation bench of 80° to 85° F. with the likelihood of injury to the cuttings where the temperature passed the 87° F. point. Another year's observations give no reason for changing this optimum range, yet it is now known that rooting may occur at much higher temperatures. In the lot of cuttings made April 15, 1929, and placed in the solar frame, an examination June 1st, or six weeks later, indicated that 181 cuttings out of a possible 221, or 81.9% had either rooted or gave evidence of rooting. Probably 90% of the 181 cuttings had aready developed a small root system. Later

examination on August 25th showed only 21% of these alive. Temperatures had reached 92° F. prior to the taking of the first records, making it seem certain that the cuttings had rooted at a temperature around 90° F. and had been able to withstand this temperature without injury to the base of the cutting. Yet the fact that they had died later left unsettled the point of critical

Fig. 6. Root development and top growth from simple and mallet cuttings, made April 21. Photographed July 15.
Left, simple; right, mallet.

temperatures for cuttings in the bench. In an effort to settle this point another year, and to see just how much heat cuttings could stand at the base, the lower sash was left on one section of the solar frame during the full summer period. An examination of this lot of cuttings on a date corresponding to that on which they were examined the previous year when only 21% were still alive, showed 95.4% of these cuttings alive and with a good root system. The weekly averages of the daily maximum temperatures for the six consecutive weeks following the insertion of these cuttings were 87.1°F; 87.1°F; 97°F; 102°F; 102°F; 97.4°F; and 105°F. The average of the daily maximum-minimum temperatures for the same weeks were: 80°F; 79°F; 87°F; 84°F; 90°F; 91°F; and 89°. This is conclusive proof that the Southern blueberry (Vaccinium virgatum) is not injured at temperatures 20 degrees F or more above that indicated by Coville for the upper limits of the Northern blueberry (Vaccinium corymbosum) and 8 to 10 degrees F. higher than we had set after the first year's observations of the Southern blueberry, provided greenwood cuttings are used and are made within the proper season when rooting is known to occur freely. The optimum day temperature however remains at 80°-85°F.

At the end of the first year's work, when the evidence at hand pointed to an optimum rooting temperature of 80 to 85 degrees Fahrenheit, with the critical temperature of 87°F, the question naturally arose as to whether there is an inherent and fixed sea-

sonal periodicity of rooting or whether cuttings made at certain seasons find such a congenial temperature for rooting that successful rooting follows. There is a successful period of rooting in early May and a second period of lesser success in early September. The five weeks following both periods are characterized by a temperature ranging from 75° to 85°F. average maximum daily temperature. This might add weight to the belief that favorable temperatures following the propagation period, rather than an inherent characteristic, explain the successful rooting at certain periods. This may be experimentally checked in two ways. Cuttings may be made in early May and placed under artificially controlled temperatures characteristic of the period following a July insertion, or they may be made in July and placed under artificially controlled temperatures characteristic of the period following the April insertion. In the lot of cuttings made May 5, 1930, and placed in a solar frame with the lower sashes left in position, and where maximum daily temperatures averaged above 96°F, the first of the above mentioned experimental conditions was more than supplied. Under these conditions 95.4% of these cuttings rooted. They were made at the correct season of the year. They were subjected to temperatures even higher than those characteristic of the period following the July insertion, a period known to be unfavorable to rooting, yet they rooted and gave the highest percentage of rooted cuttings yet recorded during the two years' work, and from over 190 lots of cuttings that have been made during this period. This adds considerable evidence to the belief that this pronounced seasonal periodicity of rooting is an inherent characteristic, and that the temperatures supposed to be optimum do not cause rooting or unfavorable temperatures prevent it, yet there is ample evidence to show that temperatures at midday above 90°F considerably abbreviate the length of the season of successful propagation; and for that reason, one would attempt to secure temperatures in the bench not exceeding 80° to 85° F. between 2:00 and 3:00 P. M.

Influence of Leaf Area on Root Development

The amount of leaf area which is left on each cutting is a point of considerable importance, especially when the cuttings used represent growth which is only a few weeks old, and therefore with a very low amount of reserve organic food stored in it from which the cutting may draw in the development of its roots. This makes necessary the presence of a reasonable leaf area on each cutting for the purpose of synthesizing its own supply of food. On the other hand, one must consider the very small water absording region of a newly made cutting, which introduces the probability of a high mortality of the cuttings in the bench before any roots are formed if too much leaf area is left to the cutting. It would seem that if humidity could be kept sufficiently high to reduce

this early mortality, it would follow that the larger the leaf area, within limits, which is left, the greater would be the development of roots and later secondary top growth. In general, this relation is shown to be true.

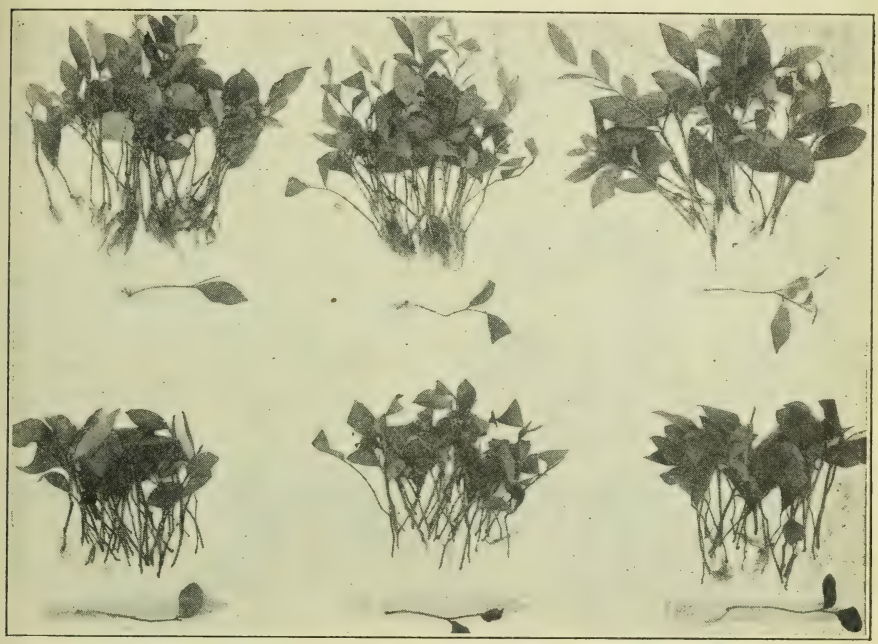

Fig. 7. Different leaf treatments showing root production and secondary top growth. Photographed July 15.
Upper row: Left, one leaf; center, one half of two leaves; right two leaves. Cuttings made May 12.
Lower row: Left, one leaf; center, one half of two leaves; right, two leaves. Cuttings made May 31.

Leaf area, reported in Table 7 and 8 was determined for each cutting by the use of a polar planimeter and the root measurements made under water in a shallow enamel developing pan. The cuttings were placed in classes based on the amount of leaf area. Table 7 and 8 show the relation of leaf area to root development and later secondary growth.

There are four worthwhile observations which come from an examination of Tables 7 and 8: first, within each of the three leaf treatments, there is a rather distinct positive correlation between leaf area and root development, giving an increased root development up to two square inches and often above this quantity; second, in spite of the truth of the above statement, there is a slight reduction in root development of cuttings with two leaves, as compared to those with one leaf; third, in every case, as shown in Table 7, greater secondary growth developed on cuttings having two leaves per cutting than on those having one full leaf or two half leaves; and fourth, two leaves each cut to one-half of its size, although a standard nursery practice, has little to commend it over one full leaf

Table 7. Influence of Leaf Treatment on Root Development and Secondary Top Growth. Records taken July 28, 1930.

Date Made and Leaf Treatment	Avg. Leaf Area Per Cutting	No. Main Roots Per Cutting	Total Lgth. Main Roots In.	Avg. No. of All Roots Per Cutting	Avg. Total Lgth. of All Roots Per Cutting In.	Avg. Lgth Secondary Top Growth In.	No. Cut'gs. Included in Meas'ment Records	Per Cent Rooted	No. Cut'gs. Included in calc. of % rooted
May 5									
½ of 2 lvs.	.97	2.18	3.27	22.51	20.46	.46	33	96	110
1 leaf	.91	2.90	5.31	33.85	30.20	.60	40	81	101
2 lvs.	1.44	2.90	4.12	20.51	19.96	1.10	30	96	186
May 12									
½ of 2 lvs.	.79	2.82	3.53	12.52	12.61	.50	23	92	37
1 leaf	.97	5.30	5.81	13.51	15.98	1.18	29	91	35
2 lvs.	1.70	3.15	3.27	6.15	7.53	1.43	19	91	33
May 31									
½ of 2 lvs.	.97	1.64	1.03	2.58	2.91	0	17	78	110
1 leaf	.95	1.54	1.30	2.26	3.79	.11	22	80	103
2 lvs.	1.55	2.60	2.43	7.24	8.15	.28	16	82	73

Table 8. Influence of Leaf Area in Root Development. Records taken July 28, 1930—Small cuttings only.

Date Made and Leaf Area Treatment	Classes according to actual leaf area in sq. in.	Avg. No. Main Roots per Cutting	Avg. Lgth Main Roots per Cutting In.	Avg. No. Lateral Roots per Cutting	Avg. Lgth All Roots per Cutting In.	Avg. Lgth Sec'd'y Top Growth In.	No. Cut'gs. in Average
½ of 2 leaves	.25 — .50	1.0	1.87	13.5	12.20	.73	4
	.50 — 1.000	2.3	2.57	20.0	19.05	.75	13
	1.00 — 1.50	2.4	3.82	25.7	22.20	3.50	7

May 5	1.50 — 2.00	3.0	7.50	26.0	45.00	0	1
	2.00 +	3.3	6.10	30.0	37.30	.80	2
1 leaf	.25 — .50	1.66	3.08	31.60	80.60	.80	3
	.50 — 1.00	2.38	4.65	31.22	27.70	.36	18
May 5	1.00 — 1.50	4.20	7.10	41.30	38.40	1.25	9
	1.50 — 2.00	3.75	6.86	40.70	37.00	1.25	4
	2.00 +	0	0	0	0	0	0
2 leaves	.25 — .50	2.00	2.75	19.00	16.00	.25	2
	.50 — 1.00	2.00	2.75	15.00	14.60	.60	5
May 5	1.00 — 1.50	2.20	2.26	18.40	17.30	1.00	9
	1.50 — 2.00	4.00	5.30	20.50	21.10	1.20	9
	2.00 +	3.40	5.10	30.60	29.40	2.60	5
½ of 2	.25 — .50	2.50	2.87	11.00	10.20	.62	4
leaves	.50 — 1.00	2.50	3.10	10.36	11.02	.31	12
	1.00 — 1.50	3.60	4.62	16.70	16.70	1.03	7
May	1.50 — 2.00	0	0	0	0	0	0
12	2.00 +	0	0	0	0	0	0
1 leaf	.25 — .50	0	0	0	0	0	0
	.50 — 1.00	5.00	4.88	11.70	14.40	5.75	9
May	1.00 — 1.50	5.37	6.20	14.30	17.20	1.71	8
12	1.50 — 2.00	0	0	0	0	0	0
	2.00 +						
2 leaves	.25 — .50	0	0	0	0	0	0
	.50 — 1.00	1.00	.25	0	.25	2.00	1
	1.00 — 1.50	2.10	1.37	1.00	1.83	.46	6
May	1.50 — 2.00	3.00	3.18	4.30	6.00	1.37	8
12	2.00 +	5.50	7.30	19.20	21.00	2.87	4
½ of 2	.25 — .50	0	0	0	0	0	0
leaves	.50 — 1.00	1.45	.96	2.70	3.03	0	11
	1.00 — 1.50	4.50	.60	0	.60	0	4
May	1.50 — 2.00	2.50	2.75	7.00	7.50	0	2
31	2.00 +	0	0	0	0	0	0

or two full leaves. It would, therefore, seem that a leaf area roughly corresponding to 1½ to 2 square inches per cutting should constitute the proper amount of leaf area where one has good control of humidity, with little justification for the additional time required to reduce the two leaves to one-half its size.

Influence on Rooting of the Size of Cuttings All Taken from Small Shoots.

It was of some importance to determine just how small the cuttings could be and yet be satisfactorily rooted, and also to determine if better rooting may be expected from the larger cuttings made from small non-vigorous shoots. Studies were made of rooting in cuttings having different diameters. After rooting, the diameters of the cuttings were accurately measured one-third of the way from the base and placed in classes according to their diameters. The relation existing between root development and various classes of cuttings based on their diameters is given in Table 9.

There are three general observations which should be made: first, rooting is satisfactory even in those cuttings with a very small diameter, and these, therefore, would not be thrown away when making cuttings, especially when the propagation wood comes from a valuable selection; second, in a general way there is a reasonable increase in root development as the diameter increases, although this is not true in all classes; third, in general, secondary top growth of cuttings is greater on cuttings having larger diameters.

Rooting in Different Types of Propagation Frames

The earlier propagation studies in the Fall of 1928 were conducted in solar frames. Comparisons each month during 1929 of rooting were made in both solar frames and propagation benches. Having found the first year what seemed to be an extremely promising lead in the observation of a seasonal periodicity of rooting, later studies were directed to the end of finding the type of frame most economical in construction and operation, and yet giving a high percentage of rooted cuttings.

Open and sash covered flue heated hotbeds, open and sash covered cold frames, open and sash covered solar frames—both with lower sashes on and off—have been compared in later studies, in addition to the frames used in earlier comparisons. Several of these types of propagation frames are illustrated in Figures 11, 12, 13, 14, 15, and 16. Almost complete failure, in both open and sash covered flue heated hotbeds has been recorded. There has been an insufficient amount of work with the open cold frame and the open solar frame to give indications of their value. Excellent results within the proper season of rooting have been secured in the propagation benches with the glass sashes above replaced by lath frames during the summer, in solar frames with lower sashes removed during the summer, and in sash covered cold frames. Comparisons

Table 9. Influence of Diameter of Cutting on Root Development.
Records made July 28, 1930.

Date	Type Cut'g and Leaf Treatment	Classes Acc'd'g Diam. Cut'g. Cm.	Avg. No. Main Roots Per Cutting	Avg. Lgth. Main Roots Per Cutt'g. In.	Avg. No. Lateral Roots Per Cutting	Avg. Lgth. All Roots Per Cutting In.	Avg. Lgth. Sec'dy Top Growth In.	No. Cutt'gs. Included in Average
May 5	Small 2-leaf	.09 — .12	3.00	4.50	16.20	15.20	.25	4
		.12 — .15	1.80	2.70	13.70	14.00	.72	7
		.15 — .18	2.40	2.37	18.10	17.20	1.35	10
		.18 — .21	3.40	7.40	32.20	3.10	1.70	7
		.21 — .24	6.00	7.50	23.50	25.50	2.50	2
May 12	Small 1-leaf	.09 — .12	4.50	4.00	14.00	14.00	.75	2
		.12 — .15	4.90	5.50	12.55	15.62	.97	9
		.15 — .18	5.11	6.00	13.90	16.45	1.30	9
		.18 — .21	5.25	6.62	14.00	16.25	.94	4
		.21 — .24	5.25	6.10	7.00	17.00	1.70	5
May 12	Small 2-leaf	.09 — .12	0	0	0	0	0	0
		.12 — .15	1.60	1.25	0	1.25	.66	3
		.15 — .18	2.40	2.25	4.80	5.75	1.00	5
		.18 — .21	4.50	5.55	13.30	15.60	2.75	6
		.21 — .24	3.40	2.75	2.10	4.55	.75	5

Table 10. Rooting at Various Seasons of the Year in Solar Frames, Slat Propagation House.
Per Cent Rooted

1929	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Solar Frame	18	18	22	82	19	11*	0	0	42	26	19	14
Slat Prop. Hse.	6	18	18	83	28	3	.8	0	46	15	36	19

* Lower sashes removed. No solar heat beneath

of rooting in these three types of frames are given in Tables 10 and 11. A comparison of rooting in the solar frames and benches of the sash house shows very little superiority of the one over the other. Both show the strong and dominant influence of season on rooting, and both give about the same results at the same season. In view of the fact that the successful period of rooting is in late Spring and Summer, glass sash overhead in the propagation house is not necessary. Lath frames tacked overhead may thus be substituted for the sash. With this cost item removed, the slat covered house possesses an advantage over the solar frame in the cost of construction and in the ease and economy of inserting cuttings in the bench and later management of them. Successful rooting in the solar frame during the Spring and early Summer has been secured with the lower glass sash removed, thus eliminating a bottom solar heat, yet if this is done, one could use a cold frame as well, with a material reduction in cost of construction. There is little, then to justify the belief that anything is to be gained by the use of a solar frame in blueberry propagation. One year's studies in the use of a sash covered cold frame with lath frame overhead have given results that are very encouraging in the effort to find a satisfactory type of frame that is cheaply constructed and one giving a high per cent of rooted cuttings. While only four lots of cuttings have been observed since it has been put into operation, and while one could not be justified in feeling that its value is definitely established from so few a number of observations, yet so far as observations go, on comparable lots of cuttings, the cold frame is the most promising of any type of frame tried so far, especially when one recognizes the ease and low cost of construction and the satisfactory rooting results, and economy of operation of the frames during the rooting period. The insertion of cuttings in a cold frame is much more difficult and tiring than in a raised type of frame, but this is not a serious objection. There is the hope and belief that in a simple sash covered cold frame with a cheap lath frame constructed overhead the solution of a practical frame for the commercial production of cuttings is seen. One would prefer to have one more year's observations before he could definitely recommend the use of this type of frame.

Influence of Different Materials and Methods of Control of Shade, Light, and Humidity

In experiments designed to determine the amount of light needed for cuttings during the rooting period observations and records have been made of the use of ten different materials or degrees of shade and light. A reasonable amount of light is necessary for photosynthetic activity in the cuttings, yet too much light increases necessarily the temperature of the propagation frame, encouraging temperatures that directly damage the cuttings or cause wilting and gradual dying. The results of observations on the use of different materials for shading and for humidity

Table 11. Rooting in Different Types of Propagation Frames. Records on July 29, 1930.

	No. of Cuttings In Record	No. of Cuttings Rooted	No. Cuttings Calloused But Not Rooted	No. Cuttings Black at Base	No. Cuttings Dead	Avg. Lgth. Secondary Top Growth Per Cutting In.	Per Cent of Cuttings Rooted or Probably* Rooting
May 5 ,1930							
Cold frame	72	68	0	4	0	1.7	94.4
Solar frame	22	21	0	0	1	1.0	95.4
Slat Prop. Hse.	75	57	3	0	7	1.0	80.0
May 31, 1930							
Cold frame	29	28	0	0	1	1.0	96.5
Slat Prop. Hse.	286	113	42	49	48	.2	54.2*
June 19, 1930							
Cold frame	54	10	28	6	10	0	44.4*
Solar frame	31	0	1	0	23	0	1.5*
Slat Prop. Hse.	176	7	16	19	100	0	8.9*

Note—Cuttings alive at base but not calloused or rooted do not show on table.
*Probable per cent rooted. Records not final.

control are given below in a summarized form rather than in a table.

1. Glass continuously over the frame—no shade—leaves are killed the first clear day.
2. Paper frames continuously over the propogation frames—no glass— cuttings look well and healthy for about two weeks, leaves after this time gradually fall and the cuttings die due to insufficient amount of light.
3. Paper and glass continuously over the frame—leaves soon drop and cuttings die due to insufficient amount of light.
4. Water-proofed muslin cloth continuously over frames—some promise, although not possible to increase or decrease light without also affecting ventilation and humidity.
5. Patented product consisting of a thin layer of opaque material on a wire base—too much light without additional shade—cuttings die as a matter of too high temperature and too much light, in a short while. No test has been made with additional shade.
6. Glass continuous with brown wrapping paper directly on the glass from 10 A. M. to 3 P. M. each clear day—results satisfactory yet probably not as satisfactory as where the paper is separated from the glass by a three inch space.
7. Glass continuous—brown wrapping paper separated from the glass by a lath frame placed each day on the frame from 10 A. M. to 3 P. M.—one of the most satisfactory methods.
8. Glass sash continuous—laths on 2 in by 1 in frames directly resting upon the glass—no additional shade—if the ratio of laths to the interval between laths is two to one results satisfactory without additional shade during midday. Seems to give too much light with wider intervals.
9. Glass sash continuous—overhead lath frame—no additional shade during the day—excellent results in limited trials.
10. Glass sash continuous—lath frame overhead with coarsely woven burlap nailed to lath frame—promising but too limited an observation to justify conclusive opinion.

As a general result of these experiments and observations, and in view of the fact that one must constantly work toward methods that are successful and toward economy in the operation of these methods, then it would seem that the most promising method of supplying shade and of control of humidity consists of the use of standard glass sash directly over the propagation frames, with a lath frame constructed overhead, supplemented by muslin cloth or coarse burlap, where a one to one (1:1) ratio of lath to interval is used; or without any additional material where a two to one (2:1) lath to interval ratio is used. The larger part of these studies has been made with lath frames on which paper has been placed each morning at 9:00 to 10:00 A. M. and removed each afternoon at 3:00 P. M. This has been very satisfactory in the results of cuttings that have rooted but this close daily attention makes this method

undersirable in large scale production, if as satisfactory rooting can possibly be secured with a method requiring less daily attention. This daily attention can be overcome by the used of overhead lath frames closely spaced; or more widely spaced but additional shade given by muslin or coarse burlap.

Chemical Stimulation of Root Production in Cuttings

Various chemicals have been used by different investigators to hasten or increase root production in cuttings. Eleven different chemicals found by Curtis, (12), and Winkler, (22), to be most promising were tried at three different times; several strengths of each shown by these investigators to have a stimulating effect on cuttings were used. There has been no material increase in the per cent of cuttings that have rooted following treatment with any chemicals. Only dormant hardwood cuttings have, so far, been tested.

Other Methods of Propagation

Realizing the fact that the hope of ever supplying commercial quantities of selected individuals from a small initial supply must center on some method less extravagant of materials than those generally used, the larger part of these studies has been with cuttings; however, some studies have been made of propagation by tubering and by root cuttings. Both of these methods have been successfully used, but both fall short in meeting the specification

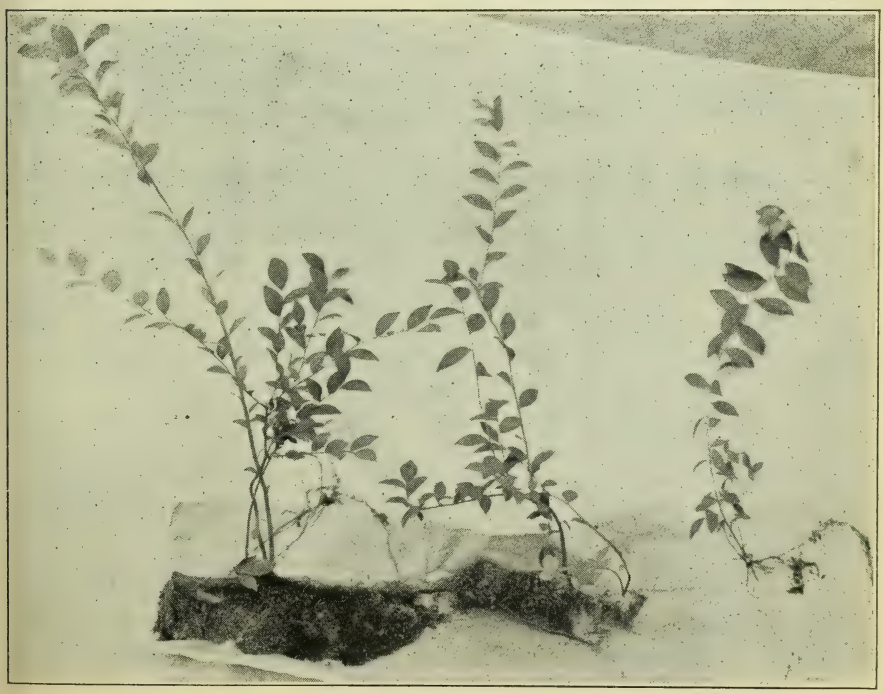

Fig. 8. One year old plant from tubering. Detached plant to the right.

of a successful method, principally because the amount of propagating material required by each method is too great to rapidly multiply a given plant and because the treatment of the parent plant is so drastic that it destroys its future as a source of propagating material. These methods, without question, have a place in propagation where a valuable selection has been made in a native clump and where every possible part of the plant is wanted for multiplication in digging up the clump.

General Observations

General observations indicate:

1. That in the Cycle of a year, there is in the blueberry plant an inherent seasonal periodicity of activities. In the Spring there is the initial flush of top growth. As this ends, root growth begins. Secondary top growth follows favorable seasons in the late Summer. A second period of root growth follows this.
2. Cuttings should be made at or just before the cyclic period characterized by the cessation of shoot growth and the beginning of root growth in the parent plant furnishing the cutting.
3. The shorter the period between the insertion of the cutting and the beginning of the period of root growth in the plant or the initiation of the rooting process in the cutting, the larger the percentage which will root.
4. At the latitude of the Mississippi Experiment Station, Spring growth begins approximately between March 5 and 10. By March 20 young shoots have reached one-half inch growth; by April 15 shoots are large enough to make cuttings three to four inches long; by May 15 small shoots have completed their growth, although vigorous shoots continue to grow for several weeks.
5. Cuttings placed in propagation frames April 21 have actively started root development by June 1, have developed a good root system by June 20, have started secondary top growth by July 1, and have developed a good top growth by July 20.
6. Secondary top growth in cuttings made in April or May never occurs until roots have been developed. Secondary top growth in cuttings made in late June and July often occurs before roots have developed, although they usually die.
7. Successive lots of cuttings made during the Spring and Summer begin making secondary top growth in the same order of the dates of insertion, but there is a material abbreviation of the period elapsing between the period of insertion and the beginning of secondary growth as the season advances.

Summarized Results of Experimental Studies

Experimental studies with the blueberry seem in general to indicate:

That rooting of cuttings is primarily a matter of an inherent seasonal periodicity of activities;

That small shoots make the most satisfactory type of cuttings;

That increasing the leaf area of small cuttings up to 2 sq. in. per cutting increases correspondingly root development and secondary top growth;

That cuttings even of very small diameter root satisfactorily, yet an increase in diameter of the cutting is followed by an increase in root growth and secondary top growth;

That a mixture of one part, by volume, of peat to one part of sand makes a very satisfactory propagating medium, with the possibility that the proportion of sand might be increased after June 1st;

That blueberry cuttings need very little ventilation during the rooting period.

That control of humidity is necessary, and is best furnished by glass;

That some shade must be supplied and is best furnished by a lath frame, supplemented, probably by muslin or coarse burlap;

That satisfactory rooting during the proper season may be secured in solar frames, cold frames, and benches in a slat propagation house;

That the cold frame, in addition to giving excellent rooting, is so simple and cheap that it probably is the type of frame most likely to satisfy the needs of a commercial method of propagation;

That chemical stimulation of rooting does not materially increase the per cent rooting;

That stumping, root cuttings, and other methods generally used in the past offer little promise of meeting the requirements of a successful method of propagation.

Part III—DETAILED INSTRUCTIONS ON SUGGESTED METHODS OF PROPAGATION OF THE SOUTHERN BLUEBERRY BY CUTTINGS

Season

Experimental studies covering two years leave no doubt but that the most favorable season for rooting blueberries extends from the 20th of April to the 20th of May in North Mississippi. The propagation period moves forward further south, and backward further north; and should be determined by the growth activity of the shoot. Cuttings can be made from the time the newly produced shoots have passed the early, succulent period and up to the time they approach the end of their growth period. There is a second period in early September when a fair percentage may be expected to root.

Methods Used in Making Greenwood Cuttings

These studies uniformly and without exception indicate that greenwood cuttings are superior to dormant hardwood cuttings provided they are made at the proper season and are properly

handled. The hundreds of small cuttings found on a large plant make excellent propagating material; however, the small fruiting shoots should be discarded. In making greenwood cuttings the cuttings should be cut from the parent plant, immediately placed in the folds of a wet cloth or towel, and the leaves at no time allowed to wilt. It is well as the shed is reached where the cuttings are to be prepared to sprinkle the leaves with water. Cuttings should not be submerged and allowed to remain under water for any length of time. They should be made into cuttings and placed in the propagation frame as promptly after their removal from the plant as possible. In preparing cuttings a clean cut is made just beneath a bud with a sharp knife. Either a simple cutting or a mallet cutting, made as illustrated in Fig 4 may be used. The top cut should be made about one-third or one-half of an inch above the top bud, the cutting being left four or five inches long. The growing point should be pinched out of a tip cutting which is still growing, stopping further top growth.

Leaf Area in Greenwood Cuttings

The amount of leaf area which is left depends upon several factors the most important of which are: the degree to which humidity is under control, and the age and character of the wood used in making the cutting. The development of any new plant structures draws upon some source of organized food. In dormant cuttings roots develop from stored material. In shoots just recently developed, stored reserves have been used up in making this growth, leaving the shoot very low in its stored food. This food must then come from material synthesized by the leaves attached to the cutting. Where humidity is under good control and where the shoots are young, yet not too succulent, then the larger the leaf area, the more rapid and the more vigorous is the root development, up to about 1.7 or 2 sq. in. per cutting. If good control of humidity is possible, then two full leaves should be left, especially during the Spring propagation period. If the humidity is under less complete control, then one whole leaf, or two leaves each of which has been cut to one-half or one-third of its original size, should be left. Cuttings under controlled humidity have rooted as high as 90% with leaf area corresponding to two leaves, one leaf, or one section of two leaves. In removing leaves from cuttings care should be observed in not stripping the bark of the cutting.

Propagation Media

In general, it would seem that a 50% mixture, by volume, of acid peat and clean sand should be used for Spring propagation, with a tendency to a larger proportion of sand, should one attempt to prolong the period of propagation into June and July. Sand should thus enable one to extend longer into the summer the propagation period. Cuttings in sand, however, produce a much smaller root system and top growth after rooting and for that reason a peat mixture is preferred. The use of pure peat has shown no

advantage over the mixture or the sand alone. Only imported peat has been tried, yet samples of Florida peat have been sent in for examination and have shown an acidity favorable to the root-

Fig. 9. Cuttings rooted in a 50% peat-sand mixture (left) make better growth in the cutting bench than those rooted in sand (right).

Fig. 10. Cuttings in the propagation bench.

ing of the blueberry, and a texture which indicates that it might be used if well pulverized. No actual propagation tests have been made in the use of Florida peat. The propagation medium should

have an acidity corresponding to approximately 5 pH on the acidity scale.

Insertion of Cuttings in the Propagation Bench

Cuttings should be placed in propagation frame as soon as possible after being prepared. After preparation, cuttings should be kept in the folds of a wet cloth until placed in the propagation frames. Before insertion of the cuttings the propagation medium should be thoroughly packed except in the case of pure peat, an opening made with a large knife or straight-edged trowel, cuttings placed ¾ inch apart in this opening and 1 to 1½ inches deep, the propagation material firmly pressed against the base of the cutting and water immediately added. The lines of cuttings should be 3 inches apart, giving 24 rows to the standard sash, if run crosswise, each row containing 50 cuttings and making a total number of 1200 cuttings per sash.

Propagation Frames

The type of frame selected should, if possible, be simple, easily and cheaply constructed, allow easy insertion of the cuttings, permit economical management of the cuttings during and after the rooting period, and yet be one which secures a maximum percent-

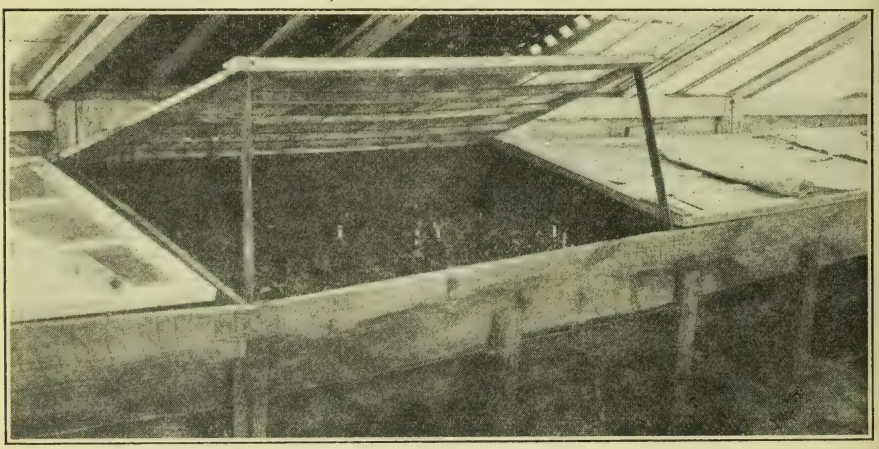

Fig. 11. A propagation bench in a sash greenhouse showing glass sash above the bench, and paper for shade on sash to the right.

age of rooted cuttings. The ultimate success in any type of frame depends much upon the season of the year the cuttings are made, the attached structures, and equipment which provides shade and furnishes control of humidity, and the general adaptability of the propagation methods to the particular frame. Successful rooting has been secured in a simple sash propagation house, in an especially designed solar frame, and in a simple cold frame. Comparisons have been made of these with a view of determining which of these comes nearer meeting the requirements above.

Sash propagation house—

Fig 12 gives one an idea of the construction of a simple sash propagation house. A single 100 ft. span or two 50 ft. spans containing one 4 ft. propagation bench to each side of a central 2 ft. walk furnishes space for 50,000 cuttings. If used during the Spring and Summer only, then lath frames above may be entirely substituted for glass sash, thereby greatly reducing the cost. If constructed of glass with 4 ft. benches, a special width sash will be required for the propagation benches proper. Where only lath

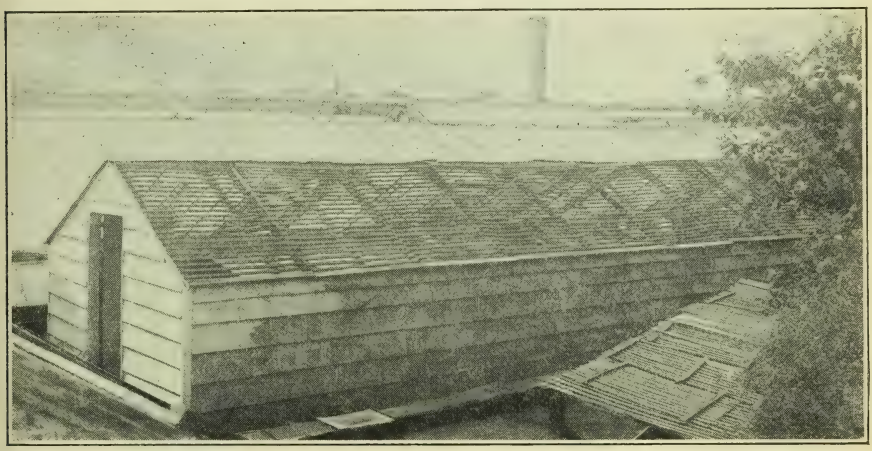

Fig. 12. A simple and easily constructed slat propagation house.

frames are used above, then the width of the house may be just as easily increased from ten to thirteen feet, allowing the use of three 3 ft. benches and two 2 ft. walks. This will permit the use of standard sashes on the propagation benches and give a bench whose width permits easy reach from the one side to the other. A large part of the propagation studies has been made in this type of structure, and results for two years furnish proof of the fact that it is entirely satisfactory. A larger part of the various comparisons made in other phases of the study was made in this type of frame.

Solar frames—

Much interest in recent years has been aroused in solar-heated frames since Swingle's, (21), studies were reported on citrus propagation by solar heat. Various designs have been suggested. Figures 13, 14 and 15 give several views of a solar frame which is very simple and original in design and one which has been quite successfully used for studies in propagation for two years. The essential features consist of a lower section covered by glass sash, with an open space extending beneath the propagation section; an upper frame supported by proper framing, with ¼ in. mesh wire bottom; a floor to the lower section separated from the ground by a 2 in. dead air space, and consisting of black building paper

or similar material to absorb heat, and cans of water to equalize heat, preventing excessive heat during the day and storing it for

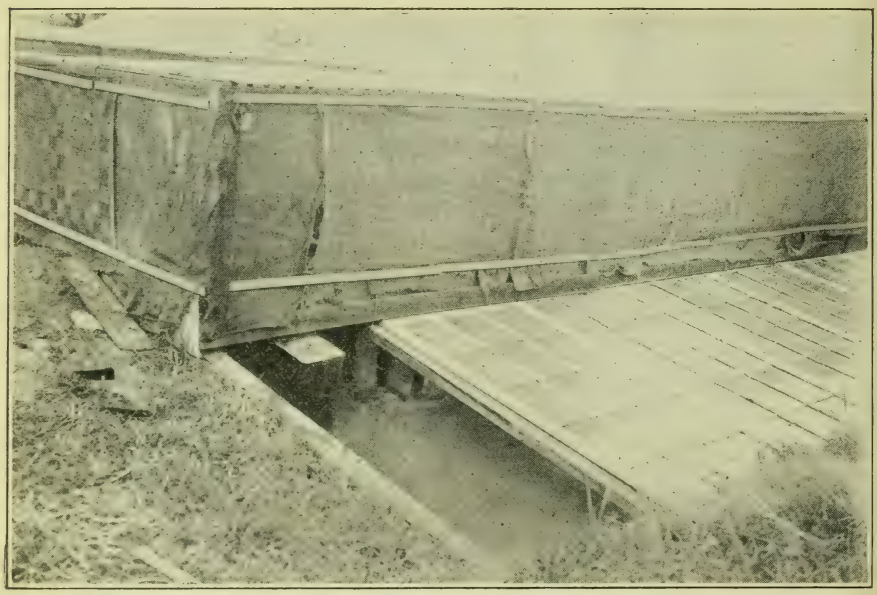

Fig. 13. The solar side of a simple solar propagation frame. Note the open space beneath the frame with tar paper on the floor of the solar section and cans beneath containing water, with lath frames above, covered with coarse burlap.

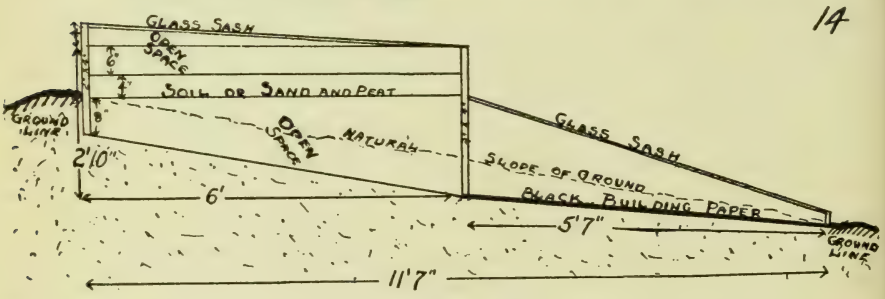

Fig. 14. End view of solar propagation frame, showing essential dimensions.

night. This design calls for a natural slope permitting a drop of 30 inches in 9 feet. Where this natural slope is absent, then it is possible to have a raised frame. Building paper absorbs the heat which passes in a natural convection current along the lower sash up to the bottom of the propagation bench, where it is cooled, and then passes downward to the floor of the lower section again. The cans containing the water should be closed or oil placed over the top to prevent loss of water. The solar frame may be used with good results during the Spring propagation season or late Fall season, but becomes too hot for Summer propagation of blueberries. The temperature in the solar frames quite often reaches 105° F. on a warm day in June, July and August, a temperature too high

for the most successful rooting of the blueberry. The lower sashes may be and should be removed during June, July and August where the blueberry is being rooted. Comparisons each month for two years of blueberry rooting in both the solar frame and the sash propagation house indicate very little difference in the two. The management of the sash house is more economical and easier, with rooting about as good during all periods and better during the late Spring and Summer periods. Solar frames, however, have given good results for the April period and for the September period.

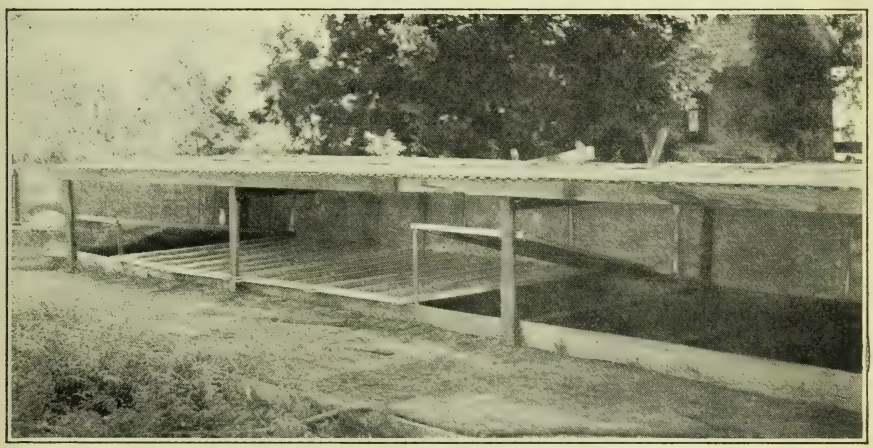

Fig. 15. The front side of solar frame showing slat frames above covered with coarse burlap and sash below resting on the frame proper. It also illustrates the essentials of a cold frame, from the one side.

Flue heated hotbeds—

Detailed description of the flue heated hotbed is to be found in Circular 65 of the Mississippi Experiment Station. Efforts to root blueberries in this type of frame at the various seasons of the year have been so unsuccessful that until further work indicates the cause of the failure, then its use is not recommnded.

Cold frames—

Unfortunately, the use of cold frames has been studied only one year, but results this year indicate excellent possibilities in a very simple type of cold frame with slats overhead and the usual glass sash over the frame proper. This frame is illustrated in Fig. 16. Cuttings placed in this frame on May 5th in six weeks had rooted 94.4%. The frame was constructed too late for the April period. Cuttings made in late May have rooted 96.5% and those inserted on May 31 give every indication of a 25% increase in rooting over every other type of frame. Johnson, in his studies at the Michigan Station reports unfavorable results from the use of cold frames as compared to solar frames in the rooting of the Northern blueberry. Different characteristics of the species worked with and different temperatures in the frames, due to dif-

ferent geographical locations of the two workers probably explain the difference in this case.

The cold frame was constructed and rootings tested in it to see to what extent each of the requirements of a successful frame could be met. Of the four types of frames tested it is simplest in construction and lowest in cost. An excellent percentage of rooted cuttings has been secured, although it must be difinitely emphasized that an insufficient number of trials has been made to difinitely establish its value. In an effort to minimize daily attentions, especially the additional shade given during the five hours of greatest heat, certain precautions observed in other frames have been omitted in this one, and excellent rooting has followed without them. This suggests the possibility that they might have been omitted in other types of frames without reduction in percentage of cuttings rooted. This has not been tested. In the construction of cold frames two ideas may be followed. Figure 15 gives views of a cold frame 6 ft. wide. Beyond the details of contruction suggested by the views of this type of frame, it should only be necessary to add that one side should be 4 inches higher than the other to allow for shedding of water during the rain, and its length should be some multiple of 3 feet if a standard glass sash is used. An occasional partition should be put in to prevent air currents. Where

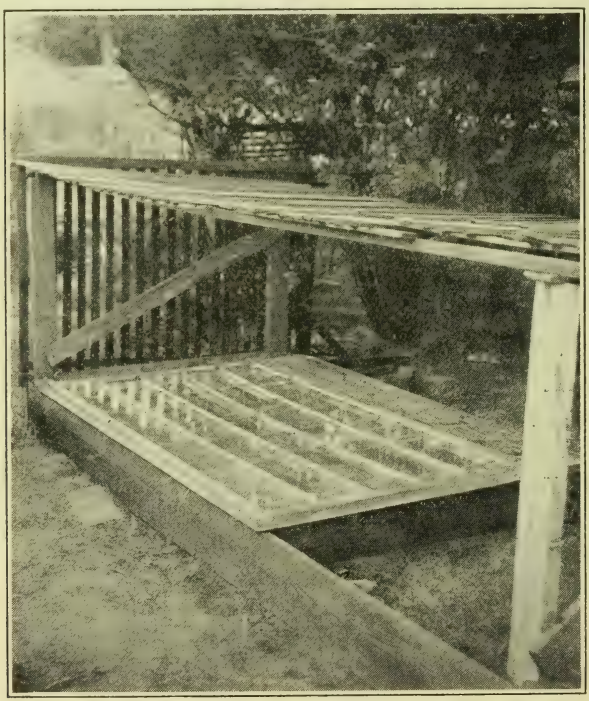

Fig. 16. A simple cold frame of easy construction and low cost. Sash resting directly on the frame with lath slats above and no additional shade. 94% of the cuttings placed in here May 5 rooted. 96% rooted of those placed in the frame on May 31.

the 3 ft. width is used and where the long bed is to be constructed, it will be necessary to construct a series of sections each consisting of two glass sash with 4 in. elevation in the center and a 3 in. tin gutter between each section to carry off rain water. Its length, then, will not be an exact multiple of 6 ft., for a 3 in. gutter must be allowed for each 12 ft. section.

General Suggestions for the Preparation of Any Type of Frame

Irrespective of the type of frame used, the same general points should be observed. Twelve inches is a convenient depth for the frame proper. The type of bottom should be one to allow free drainage of water, free circulation of air, to resist decay itself, and to discourage decay of cuttings. Hardware cloth or ¼ in. mesh wire has been very satisfactorily used in most of this work. Cypress bottoms have been used, but apparently with less success in rooting, although its use is possible. Various materials such as tile, slate, and certain compositions might be found equally as satisfactory as the hardware cloth. Four or five inches of sand, or a mixture of sand and peat, should be placed in the frame, leaving six or seven inches of air space above for the cuttings. In cold frames about five inches of the propagation material can be placed immediately on a well drained soil. Frames should usually run east and west with the slats above running north and south, thus affording alternate sun and shade for each part of the frame. A frame running north and south with a tall hedge to its west is satisfactory provided the slats overhead extend over the eastern side sufficient to offer shade to the cuttings by nine o'clock in the morning. Frames running north and south should also have the lath above running in the same direction.

Providing Shade, and Humidity Control.

Blueberry cuttings must be shaded during the heat of Summer days, a high humidity constantly maintained until the cuttings have rooted, and only an extremely small amount of ventilation given. After rooting is secured, the glass sash can be gradually raised, lowering the humidity and increasing the ventilation, but still maintaining at least the lath shade overhead. Of five different materials tested for humidity control, glass is the outstanding choice. Water-proofed cloth offers some possibilities, but with it, shade and humidity control is combined in one material, making impossible the regulation of the one without the other. Shade may be furnished in a variety of ways. Laths tacked on the edge of a 1 in. by 2 in. strip placed directly on the glass sash, or an overhead lath structure, are the two most generally used methods of providing shade. These may furnish all the shade given, or serve as frame for additional shade. If they furnish all the shade given the cuttings, then one-half of a single lath should separate each lath tacked on the frame, giving a lath-interval ratio of two to one (2-1). If used for support of additional shade,

this ratio should be one to one (1-1). Several materials may be used as additional shade. Heavy brown wrapping paper placed each day at 9 or 10 o'clock on the lath frame and removed in the afternoon between 3 and 4 o'clock has been very successfully used. Coarsely woven burlap sacks torn open and tacked on the frames, or muslin cloth may be used, thus eliminating the necessity of daily removal of the additional shade. Efforts up to the present time to secure satisfactory rooting without both shade and glass overhead have been unsuccessful with greenwood cuttings.

Watering

Careful and correct watering plays an extremely important part in successful handling of the cuttings during the rooting period. Over-watering or under-watering means failure. The accumulation of free water in an opening made in the propagation material with a trowel means entirely too much water. One should be unable to press out free water from a small quantity of the material when gripped in the hand, yet pressure should make evident small amounts of water on the surface of the pressed material. Considerable differences of opinion may be found in suggestions from different investigators regarding the frequency of watering. Coville states, "Watering should be as infrequent as practical . . . the period between necessary waterings may extend over several weeks." Experience here has led us to believe that

Fig. 17. One year old plants from cuttings made January 20, April 15, and May 16, (left to right. Photographed May 5 the following year. These should be grown one year in the nursery before final transplanting.

a daily examination of any raised type of bed is desirable and the addition of water as conditions justify. It is very seldom that a week of sunshine passes in June or July that the cuttings are not watered three times each week. Cold frames with the propagation material resting directly on moist ground require less fre-

quent watering. One should be advised to guard against the continuous use, in the watering of propagation frames, of hard water since the general effect of hard water on the reaction of the soil is to change it from an acid to a basic reaction. One probably should have the water tested for its acidity before using it very long on blueberry propagation frames, and an effort made to keep the acidity of the propagation medium approximately at a pH of 5.

After rooting, cuttings should not be disturbed until early winter, when they should be dug and handled in the nursery row at least one year before planting to their permanent position.

SUMMARY

1. The expansion of commercial plantings of selected blueberries in every potential blueberry growing section of the United States today hinges on the development of a successful method of propagation.

2. A successful method of propagation must be rapid, certain, and economical of propagation material, permitting in a short time rapid multiplication of plants from a small inital supply.

3. A critical examination of the various methods now generally used shows that they are too uncertain, too slow, or too extravagant in the use of materials and of propagation space ever to offer a solution to the propagation problem.

4. The use of small cuttings, thousands of which may be found on one large plant, offers the most promising method of propagation if a successful method can be found for rooting them.

5. In the past, failure or small success has attended efforts to root blueberry cuttings.

6. Results from two years of expermential work at the Mississippi Experiment Station have shown that blueberry cuttings root with comparative ease if they are made at the proper season, using the proper kind of cuttings, and supplying favorable conditions for rooting.

7. The proper season for rooting cuttings immediately precedes the termination of the Spring flush of growth in the plant from which the cuttings are taken, a period which normally occurs at this latitude during the last week of April and the first two weeks of May.

8. The proper kind of cutting is that made from young shoots just nearing the end of their Spring period of growth.

9. Favorable conditions for rooting are supplied by leaving on each cutting sufficient leaf area to enable the organic food needed for root development to be synthesized, by supplying an atmosphere where humidity is sufficiently high to prevent wilting of the cuttings from excessive transpiration, by offering a sufficient amount of light to enable photosynthetic activities to proceed normally, and yet offering shade sufficient to prevent temperatures in the bench from becoming excessive; by careful regulation of the moisture in the propagating medium, supplying a sufficient amount of water to meet the needs of the cutting, yet

not oversupplying it to the extent that air is excluded from the base of the cutting; and by the use of close fitting frames so constructed as to reduce air currnts within the frame and air exchange between the inside and outside of the frame.

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GRAPE VARIETIES

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INTRODUCTION

The purpose of this bulletin is to give the results obtained in testing fifty-five varieties of bunch grapes and sixteen varieties of muscadines. Four plants of each variety of bunch grapes were planted in rows ten feet wide and vines were planted ten feet apart in the rows. The vines were trained to the recurve fan system and pruned regularly. Two vines of each variety were sprayed, and two vines were not sprayed, in order to determine their resistance to disease. Records were made of the sound fruit harvested, the per cent of rotten fruit, resistance to drouth and winter injury, the character of the bunch, berry, flavor and quality.

Three vines each of the muscadine varieties were planted in rows ten feet wide and twenty feet apart in rows, trained to the four-wire Kniffen system, and regularly pruned, but not sprayed. Records were taken on the vineyard performance of each vine.

RED GRAPES

Amber—Good grower, very productive. Bunches large, fairly compact. Berries large, juicy, sweet, of good quality. A good table grape. Very susceptible to disease. Injured by drouth. Average ripening date, July 19.

Brighton—A medium grower, medium productive. Bunches long, large, sometimes shouldered. Berries large, bright red, with little bloom, very showy, very sweet, of very good quality. Excellent table grape. Very susceptible to disease, fruit rotted badly. Suffered from drouth. Very short-lived. Average ripening date, July 20.

Captivator—Medium grower and producer. Medium bunches of large, red berries of high quality. A very good table grape. Resistant to disease. All vines killed third year by drouth. Average ripening date, July 24.

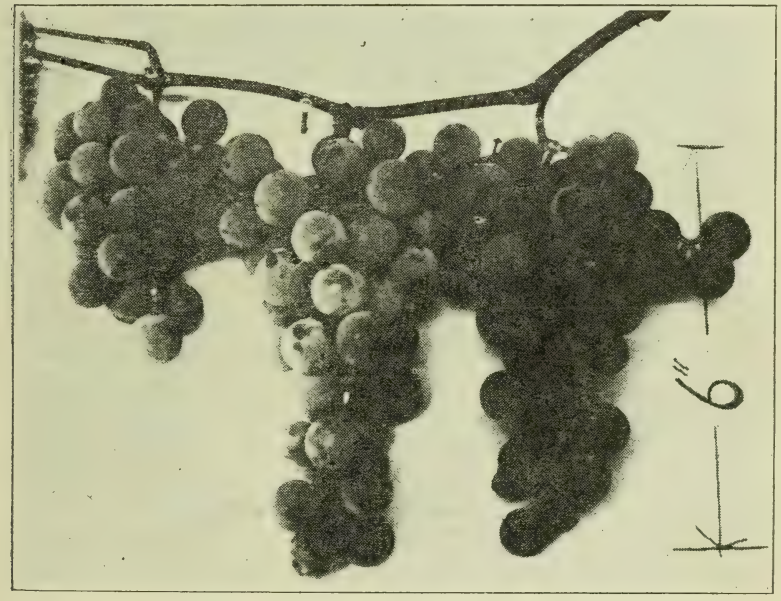

FIG. 1—SHOWING THE FRUITING HABIT OF CATAWBA

Catawba—Vigorous vine, very productive. Bunches large, long, compact, often shouldered. Berries large, sometimes varying in size; dark red when full ripe; skin

thin, tough; flesh tender, juicy, sprightly, with very fine flavor. Susceptible to anthracnose, must be sprayed. Very resistant to drouth or other seasonal injury. Ripens late. Highly recommended as a table grape. Average ripening date, August 10.

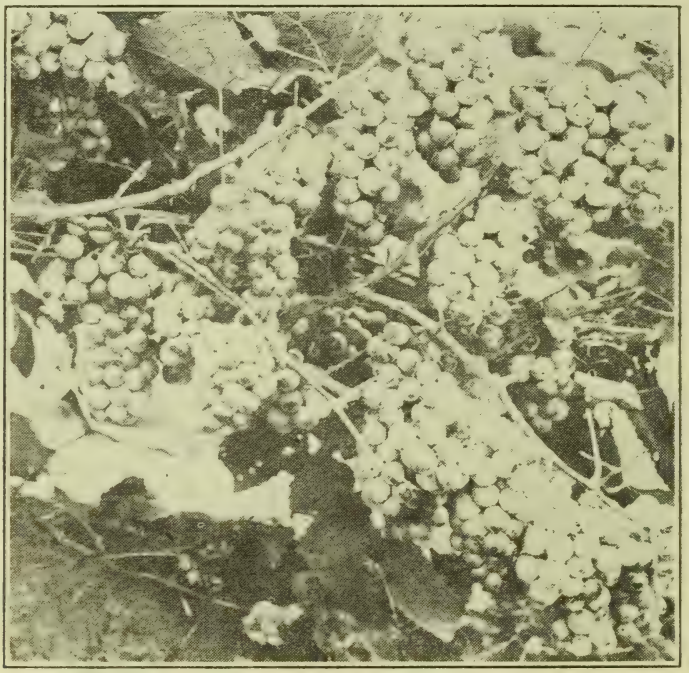

FIG. 2—A PORTION OF A DELAWARE VINE.

Delaware—A medium slow grower, medium productive. Bunches medium to small, very compact, sometimes shouldered. Berries medium, bright red, translucent; skin thin, tough; flesh tender, very juicy, of the best flavor. Has shown a trace of anthracnose, and is subject to black rot. Very resistant to drouth or other seasonal injuries. Highly recommended as a table grape for both commercial plantings and home use. Average ripening date, July 20.

Delicious—Medium grower, poor producer. Very susceptible to diseases. Not recommended. Average ripening date, August 1.

Fern Munson—A weak grower, a fair yielder. Re-

sistant to disease but not to drouth. Most of plot died during dry weather. Average ripening date, August 18.

Headlight—A weak grower, light yielder. First to ripen. Nice bunches of good quality. Good table grape. Subject to disease, injured by drouth. Most of vines dead. Average ripening date, July 10.

Iona—Medium grower, medium productive. Bunches medium. Berries large, sweet, of good quality. Good table grape. Severely damaged by diseases on wood and fruit. Not desirable. Average ripening date, July 22.

Ladano—A good grower, medium productive. Resistant to disease. All vines died during drouth. Average ripening date, July 29.

Last Rose—A medium grower, producing light crop. Anthracnose medium, and black rot bad. All vines dead. Average ripening date, August 1.

Lindley—A very vigorous grower, very productive. Very large, long, slender bunches. Berries large, translucent, dark red; skin thin, tough; flesh tender, juicy (juice colorless), sweet, of very good quality. Excellent table grape. Very susceptible to disease, spraying necessary to produce crop. A desirable variety. Average ripening date, July 20.

Lucile—A fairly vigorous grower, a fair bearer. Bunches slender, loose. Berries large, red; skin medium thick, tender; flesh tender, sweet. A table grape of good quality. Fairly resistant to disease. Damaged by drouth. Average ripening date, July 17.

Lutie—A good grower, very productive. Bunches medium to large, fairly regular; so compact that berries are often squeezed out of shape. Berries ripen fairly evenly on bunch. Berries dark red; skin medium thick, tender; flesh very tender, hard to separate from seed, juicy, with foxy odor and taste, sweet, of good quality. A fine table grape. A poor keeper. Very resistant to disease, only 10 per cent rot on unsprayed vines in vineyard. No rot on unsprayed vines one-fourth mile from main vineyard. Severely damaged by drouth. Recommended for home planting, especially for people that will not spray fruit. Average ripening date, July 18.

Mericadel—Medium grower, productive. Bunches

medium, compact. Berries medium, dark red, subacid, of good quality. Good for table use. Resistant to disease. Vines planted 1927, and for the short period under trial appear desirable. Average ripening date, August 10.

Salamander—Very vigorous grower, productive. Bunches long, slender, medium, compact. Berries medium, red; skin thin, medium tough; flesh tender, juicy, colorless, sweet, of very good quality. A good table grape. Resistant to disease and drouth. Desirable for market and home use. Average ripening date, July 29.

Valhallah—A very vigorous grower, fairly productive. Bunches medium to small, fairly compact. Berries large, red; skin thin, tough; flesh medium tender, medium juicy, acid, of fair quality. Good for culinary purposes. Very susceptible to disease. Average ripening date, August 12.

WHITE GRAPES

Albania—A medium grower, medium productive. Bunches large to very large. Berries medium. Very susceptible to disease, very little sound fruit harvested. Average ripening date, August 19.

Armalaga—A good, vigorous grower, productive. Bunches large and compact. Berries large, translucent; skin thin and tough; flesh tender, juicy, sweet, of very good quality. Rather susceptible to disease. All vines dead. Average ripening date, August 10.

Bell—A good grower, fairly productive. Bunches medium, fairly compact. Berries medium, juicy, of good quality. Badly affected with rot. Damaged severely by drouth. Average ripening date, August 1.

Blondin—A good grower, but not productive. Damaged severely by drouth; three-fourths of planting dead. Average ripening date, August 4.

Beta—A medium grower, light producer. Very susceptible to disease. Not desirable. Average ripening date, July 22.

Diamond—A medium grower, very productive. Bunches large to very large, heavy shouldered, very compact. Berries medium to large, a transparent light green when full ripe; skin thin and tender; flesh very tender, colorless, melting, subacid, of very good quality. Too tender to ship

to distant markets. Subject to black rot, must be sprayed. Withstands drouth well. Average ripening date, July 20.

Dutchess—A good grower, very productive. Bunches large, slender, heavy shouldered, very compact. Berries medium, translucent; skin thin, tough; flesh tender, vineous, with very pleasant flavor, of very good quality. Severely attacked by anthracnose, but when kept free from disease, produces excellent crops. Average ripening date, July 25.

Edna—A poor grower, severely injured by drouth and disease. All vines dead.

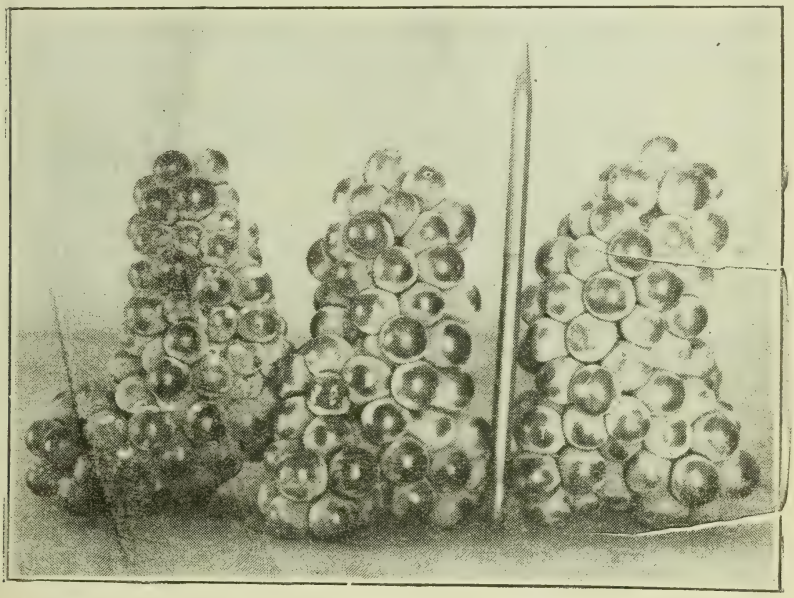

FIG. 3—SOME NICE NIAGARA BUNCHES.

Niagara—A rank grower, should be planted 12 feet apart. Bunches borne in large to very large, long, compact clusters, often shouldered. Berries large to very large, a bright amber color when full ripe, translucent; skin thin, tough; flesh colorless, tender, juicy, sweet, of good quality, slightly foxy. Good keeper and shipper. Resistant to anthracnose but subject to black rot. When timely sprayed, produces excellent crop. Is easily damaged by drouth

or excess of rain. Shows tendency to be short-lived. Recommended for commercial planting. Average ripening date, July 26.

Ronalda—A vigorous grower, produced very little fruit on account of anthracnose attacking the young fruiting shoots. All vines dead.

Triumph—A weak grower, productive, resistant to disease, but short-lived. Not recommended.

Winchell—A medium grower, productive Bunches medium to small, compact. Berries small; skin thin, tough; flesh tender, juicy, very sweet, of excellent quality. Resistant to disease. Severely damaged by drouth. All vines dead. Average ripening date, July 28.

BLACK GRAPES

America—A medium grower, medium productive. small compact bunches that do not shatter fruit. Fruit of good quality. Both vine and fruit are rather resistant to anthracnose and black rot. Resists drouth and other extremes of environment poorly, making vines short-lived. Average ripening date, July 20.

Bacchus—A good grower, very productive. Medium compact bunches. Poor quality for eating, good for culinary purposes. Rather resistant to disease and drouth. Average ripening date, July 28.

Ben Hur—Vigorous, fairly productive. Very susceptible to disease. Not desirable. Average ripening date, July 24.

Carman—Vigorous grower, medium bearer. Small bunches, medium berries, of acid flavor and poor quality. Good for culinary purposes. Resistant to disease and drouth.

Campbell—A medium grower, fairly productive. Bunches ragged. Extremely susceptible to anthracnose and black rot, 11 per cent rot on sprayed vines, 80 per cent on unsprayed vines. Average ripening date, July 21.

Champanel—A fair grower, light producer. Fruit badly damaged by disease. Short-lived vines. Average ripening date, July 27.

Cloeta—A poor short-lived variety, very susceptible to disease on both wood and fruit. Produced no marketable

fruit. Average ripening date, July 25.

Concord—A good grower, a heavy producer. Resistant to anthracnose, but subject to black rot. Seldom ripens uniform bunches. A splendid variety for market and home use when irregular ripening is overcome. Average ripening date, August 1.

Clinton—A strong growing vine, but produces no fruit in this section.

Daisy—A slow grower, early, medium bearer. Medium bunches of good quality. Resistant to black rot. A desirable variety due to its earliness. Average ripening date, July 12.

Eclipse—A medium grower and light producer. Fruit of fair quality. Rots badly. Not desirable. Average ripening date, July 20.

Ellen Scott—A good grower, medium productive. Produced no fruit on unsprayed vines. Short-lived. Bunches large, fruit of good quality.

Extra—A fairly vigorous grower, productive. Large, long, shouldered bunches of compact berries. Berries medium, dark purple, no pigment; subacid, of good quality. Good for table use. Resistant to disease. Suffers from drouth. A promising variety. Average ripening date, August 1.

Herbemont—A vigorous grower, productive, long-lived. Good for culinary purposes. Bunches medium to small; berries very small, of poor quality. Free of anthracnose, but very subject to black rot. Not desirable. Average ripening date, August 20.

Hicks—Almost identical with Concord in vine, fruit, and habits. Average ripening date, August 4.

Jacquez—A very vigorous grower, a heavy producer of large, long, loose bunches, sometimes shouldered. Berries small, black, with blue bloom; skin thin and tough; flesh tender, purple, juicy, acid, of poor quality. A good jelly grape. Average ripening date, August 15.

Lomanto—A very vigorous grower, producing heavy crops of medium sized bunches. Berries medium, thin skinned, of fair quality, with a slight foxiness. Ripens early. Fine for cooking and preserving. Very resistant

to drouth and winter injury. A desirable variety. Average ripening date, July 24.

Lukfata—A very vigorous grower, producing many short, compact bunches of medium size, ripening uniformly. Berries large, black, medium tough skin, and tender pulp. Fair table grape and excellent for culinary purposes. Subacid, of good quality. Resistant to disease and long-lived. Very desirable for this section. Average ripening date, August 1.

Manto—A vigorous grower, fairly productive. Bunches small, medium compact. Berries large, black, ripening evenly; skin thick, tough, with much pigment; seed large; subacid, of good quality. Resistant to disease, suffers from drouth. Fair table grape. Average ripening date, August 1.

R. W. Munson—A vigorous grower, fairly productive. Bunches large, showy, ripening uniformly. Berries large, of good quality. Vine and fruit subject to disease, short-lived. Average ripening date, July 26.

Moore's Early—A very poor grower, a light bearer. Bunches medium, compact; berries large, of good quality. Has a tendency to ripen irregularly. Resistant to anthracnose, but subject to black rot. Desirable on account of its earliness. Average ripening date, July 10.

Muench—A vigorous grower, a heavy producer of large, long compact clusters. Berries medium, dark purple; skin thin, tough; flesh tender, juicy, sweet, of high quality. Resistant to anthracnose and very little black rot on unsprayed vines. Fruit colors two weeks before ripe—judge ripe fruit by taste, not color. Very late, ripens after other varieties are gone, fills in gap nicely between other bunch grapes and muscadines. Very desirable for home use and market. Very resistant to drouth. Average ripening date, August 18.

President—A fairly vigorous grower, fairly productive. Medium compact bunches; berries large, black, of good quality. Resists anthracnose, but subject to black rot. Ripens early. Is severely injured by drouth. Average ripening date, July 20.

Victor—A poor grower, and producer. Very susceptible to disease. Injured by drouth. Not desirable.

Worden—A medium vigorous grower, productive. Large, well filled bunches of large berries. Like Concord, ripens bunches very irregularly, some seasons worse than others. Sweet, of good quality. Resistant to drouth. Average ripening date, August 5.

The fifty-five varieties under test show a very striking difference in their behavior in the vineyard in regard to productiveness, habit of growth, resistance to drouth, winter killing, disease, etc. All plantings of eleven varieties are dead, three-fourths of ten additional varieties are dead, and one-half of another ten varieties is dead. The cause of the deaths of the several varieties were disease, drouth, and winter killing, following severe drouth in late summer.

In many cases the unsprayed vines died, while the sprayed vines of the same variety are healthy, and are producing good crops of fruit. This is true of Diamond and Niagara. The Lutie, a variety very resistant to disease, produces heavy crops in normal seasons, while in 1926 the fruit shriveled on the vine, and the same season many vines died. At this writing a drouth has prevailed for ten weeks, and the fruit is badly shriveled. Much of it will not be harvested. The Muench and Lukfata, growing in adjacent rows, are showing hardly a trace of drouth injury.

The Concord bears regular and full crops, but fails to mature all berries on the bunches. Sometimes, as many as 30 per cent of the berries remain green, after the ripened berries have been picked, until frost, never coloring, but becoming sweet and edible. Many black varieties fail to ripen bunches uniformly. Very few red and white varieties fail to ripen bunches perfectly. Muench ripens very late, but colors fully two weeks before ripe. The Muench variety is of best quality and should be in every planting.

The Catawba, a very old variety, still holds a place in the grape list. It ripens at a season when most of the varieties are gone. Its high quality, delicious flavor, and productiveness is unsurpassed for its season. The Delaware is of the highest quality and the best market grape. Its yield is not high, but selling price is at the top. The vines may be grown as close as eight feet, making more vines per acre and increasing the yield. The Diamond ripens with the Delaware, but cannot compete with it as a commercial grape, since the Diamond crushes too easily to ship to distant markets.

A study of the origin of the different varieties was made to determine their resistance to disease. It appears that specie or combination of species does not determine resistance. The data also tend to show that color does not influence resistance to disease.

MUSCADINES

The muscadines or Rotundifolia grapes are found growing wild from Maryland to Texas. They are usually found growing along banks of streams, on the edge of swamps, often climbing to the top of tall trees. With trees for trellis, and nature the caretaker, large crops of delicious fruit are produced regularly. As disease and insect rarely attack them, no spraying is necessary. The early settlers recognized the value of these grapes, their freedom from disease, and so transplanted choice vines to their yards and gardens, trained them on arbors, and prized them for their

FIG. 4—A TWO-YEAR-OLD MEMORY GRAPE VINE.

fruit and beauty. Because of different colors of fruit, these grapes have been divided into two groups, namely, scuppernong (white), and muscadine (black).

There is a tradition that the scuppernong was found on Roanoke Island at the time of the landing of Sir Walter Raleigh's colony, and it is said that the original vine is still growing on this island. The early settlers propagated these grapes by seed, pulling out all vines bearing black fruit. The varieties are now propagated by layerage; therefore, a grower should get what he buys.

A number of varieties of muscadines have been planted at this Station to determine the most suitable varieties for growing in Mississippi. Notes on their habits of growth date of ripening, yields, and quality of fruit have been taken. A brief description of these is given below.

Pollination of Muscadines

In rare instances are perfect flowers produced on the muscadine group of grapes. This group, as a rule, produces two kinds of flowers, male and female. The staminate, or male flowers, are borne in abundance on non-bearing vines; the female, or pistillate, flowers are produced on the fruit producing vines. These vines will not produce fruit unless growing near the male vine. One male vine will produce sufficient pollen for thirty fruit-producing plants.

Frequently the cause of scuppernong arbors not producing fruit is the fact that there are no pollen producing plants near. Two plantings were made here at this Station, one with the necessary number of pollen producing plants, and another with no pollen producing plants closer than one-fourth mile; and these were beyond a hill. Those with pollen producing plants near produced heavy crops ranging from 40 pounds to 100 pounds. The plants with no pollen producing plants near produced less than one dozen berries each. Some of the vines produced no fruit at all. Three privately owned arbors in Starkville produced no fruit. One pollen-producing plant furnished each of these arbors with sufficient pollen at two years of age to produce a good crop of fruit.

VARIETIES

White Muscadines

Howard—A weak grower, poor producer. Bunches

small, 4 to 8 berries, medium, bronze color. Skin thin, tough; flesh green, no pigment. Quality good. Average ripening date, September 1.

Kilgore—A medium vigorous grower, very productive. Large bunches, 10 to 15 berries. Berries medium, translucent, light pink color; skin very thin, tough, no pigment; flesh light green, very tender, mild subacid, of very good quality. Hangs on vine well after ripe. May be harvested in bunches. Very desirable. Average ripening date, September 10.

San Rubra—Medium vigorous, fairly productive. Bunches large, 6 to 10 berries. Berries medium; skin thin, tough; flesh green, tender. Subacid, of good quality. Average ripening date, September 4.

Scuppernong—A vigorous grower, very productive, medium bunches, 3 to 8 berries. Berries medium to large, dark bronze when fully ripe. Bunches do not ripen uniformly, making the fruit troublesome to harvest—the only outstanding fault of this variety. Skin medium thick, tough; flesh tender, sweet, of very good quality. Very desirable for eating or culinary purposes. Average ripening date, September 4.

Black Muscadines

Clarke—This variety was found growing on the bank of Lime Creek by Mr. M. D. Clarke and the author, and was named in honor of Mr. Clarke. A rooted portion of this vine was transplanted to the Station vineyard. This variety has produced splendid fruit under cultivation. A vigorous grower, productive; large bunches of 8 to 10 berries, rather compact. Shatter easily. Berries round, very large, 15-16 of an inch, reddish brown color, red when produced in shade, with slight trace of blue bloom. Many large russet dots raised above surface. Skin medium thick and tough. Flesh greenish white. Ripens very late, average date, October 1.

Eden—A medium vigorous grower, productive, very early. Is damaged by drouth and winter kills. Bunches medium, compact, 8 to 16 berries. Berries small, round, black; skin thin, tough; flesh tender, juicy, pink, with much pigment in skin and some in flesh. Two to three small brown seed, very sweet, of very good quality. Good for

eating or culinary purposes. Average ripening date, August 25.

FIG. 5—A FLOWERS GRAPE VINE. NOTE THE CROP OF FRUIT. NOTE METHOD OF TRAINING.

Flowers—A vigorous grower, very productive. Bunches medium, 5 to 15 berries, rather compact. Berries large, roundish oblong, very black, with many small russet dots. Skin medium thick, very tough, full of pigment; pulp solid, hard to separate from seed; subacid, of good quality. Is fully colored long before ripe. Excellent for cullinary purposes; fair for eating, if allowed to ripen thoroughly. Average ripening date, September 20.

George—A medium vigorous grower, productive. Bunches medium, 5 to 11 berries. Berries large, slightly oblong, dark reddish brown; skin medium thin, tough, contains pigment; flesh tender, juicy, light green; subacid, of good quality. Average ripening date, September 8.

Hunt—A fairly vigorous grower, medium productive. Bunches medium, 5 to 10 berries. Berries medium, slightly oblong, black; skin medium thin, tough; flesh green, with

much pigment, very sweet, of high quality. A very de
sirable variety. Average ripening date, August 28.

Irene—A very vigorous grower, very productive. Ver
resistant to drouth and disease. Bunches medium, compact
5 to 10 berries. Berries large, black, with trace of blu
bloom; skin medium, tough, much pigment; flesh colorless
juicy, tender, sweet, of very good quality. Highly recom
mended. Average ripening date, September 5.

James—A vigorous grower, an early bearer, and heav
producer. Bunches small, 3 to 6 berries. Berries large
black, round; skin thick and tough, with much pigment
flesh tender, sweet, of good quality. Foliage and frui
subject to black rot. Average ripening date, September 1

La Salle—Vine medium vigorous, poor producer. Suf
fers from drouth and winter killing. Bunches medium,
to 10 berries, compact. Berries large, slightly oblong
black, covered with blue bloom; skin thin, tough, contain
much pigment; flesh colorless, tender, juicy, sweet, quality
very good. Average ripening date, August 26.

Luola—A medium slow grower, vine fairly productive
is injured by severe drouth. Bunches medium, 10 to 2

FIG. 6—A CLOSE VIEW OF THE MEMORY GRAPE.

berries. Berries small, black; skin thin, tough, with much pigment; flesh green, subacid, of poor quality to eat from vine, but good for culinary purposes. Average ripening date, September 15.

Memory—Vine very vigorous, very productive, very resistant to drouth, holds foliage late. Bunches small, 3 to 9 berries, ripen uniformly. Berries very large, slightly oblong, black, with little bloom; skin medium thin, tough, with much pigment. Sweet, of very good quality.

One vine of this variety has the following record:

2nd year, 2½ pounds; 3rd year, 20½ pounds; 4th year, 63½ pounds; 5th year, 88 pounds; 6th year 103½ pounds; 7th year, 82 pounds.

Very good for eating or culinary purposes. Average ripening date, August 28.

San Jacinto—Vine medium vigorous, medium productive. Resistant to drouth. Bunches medium, 8 to 10 berries. Berries medium, black in color; skin medium tough, with medium pigment. Flesh green, tender, juicy, of good quality. Average ripening date, August 28.

Spalding—Vine medium grower, fair producer. Suffers from drouth. Bunches medium to small, 3 to 9 berries. Berries medium, black; skin medium thin, tough; flesh tender, juicy, sweet, of good quality. Average ripening date, September 2.

Of the sixteen varieties of muscadine grapes in the test, each has some merit. The Eden for its earliness, and sprightly, musk-like flavor; the Irene for its beautiful, productive vine and delicious flavor; the James for the quickness of the vine to come into bearing and the large size of its fruit; the Memory for its productiveness, large berries, delicious flavor, uniform ripening, ease in harvesting and healthy vine; the Scuppenong for its beautiful arbors and splendid fruit for table use; the Kilgore for its lateness and delicious table qualities; the Flowers for its extreme lateness and culinary value. From a checking over of the varieties of this group, the following are recommended for planting in Mississippi in order of ripening: Eden, Memory, Scuppernong, Irene, Kilgore, and Flowers.

The grower of muscadines should keep in mind when vines are planted to the field, the fact that weeds will choke out the young plants and rob the bearing plants of plant

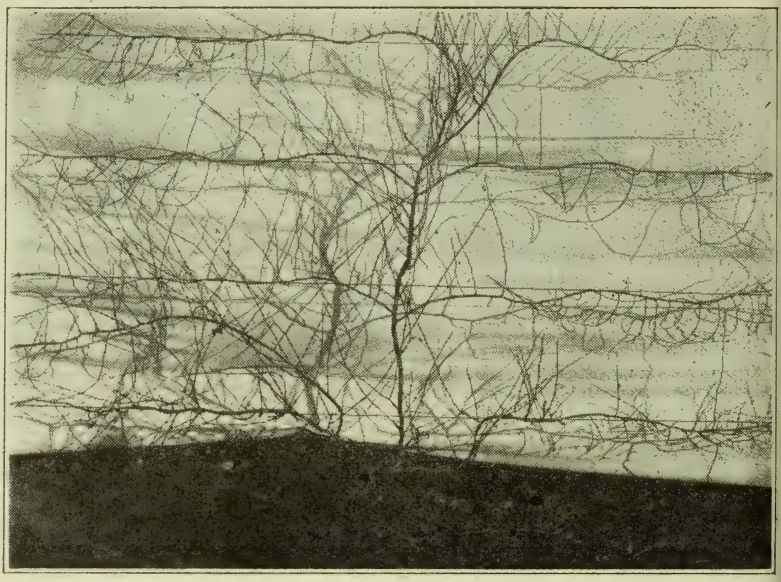

FIG. 7—A MUSCADINE VINE BEFORE PRUNING.

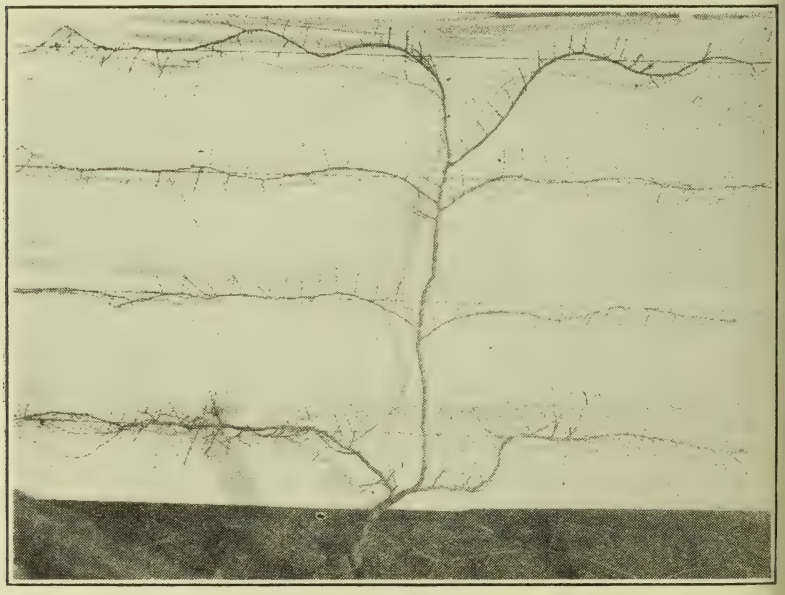

FIG. 8—A MUSCADINE VINE AFTER PRUNING. NOTE THE ANNUAL GROWTH IS CUT BACK TO THREE OR FOUR BUDS TO EACH SPUR.

food and moisture; therefore, cultivation is necessary. The cultivation should be shallow and frequent enough to keep down the grass.

A good trellis should be provided for all grape vines. The three or four wire trellis is best. The old style arbor may be used with satisfaction.

A careful study of bunch and muscadine grapes was made to determine the most suitable varieties for planting. There are other varieties not listed in the twelve varieties of bunch grapes and six muscadine varieties that have desirable qualities. The fewest number of varieties is best, as spraying is easier, and the halthiest and best quality varieties may be picked. The writer has kept in mind good quality, resistance to disease and drouth, and grapes over as long a period as possible, in naming the following varieties:

Moore's Early—Black. Average ripening date ..... July 10
Lutie—Red. Average ripening date ..... July 18
Lindley—Red. Average ripening date ..... July 20
Delaware—Red. Average ripening date ..... July 20
Diamond—White. Average ripening date ..... July 20
Lomanto—Black. Average ripening date ..... July 24
Niagara—White. Average ripening date ..... July 26
Salamander—Red. Average ripening date ..... July 29
Concord—Black. Average ripening date ..... August 1
Lukfata—Black. Average ripening date ..... August 4
Catawba—Red. Average ripening date ..... August 10
Muench—Purple. Average ripening date ..... August 18

Muscadines—

Eden—Black. Average ripening date ..... August 24
Memory—Black. Average ripening date ..... August 28
Scuppernong—White. Average ripening date ..... September 4
Irene—Black. Average ripening date ..... September 5
Kilgore—Pink. Average ripening date ..... September 10
Flowers—Black. Average ripening date ..... September 20

SUMMARY

Grape growing is profitable if good varieties are selected and good care given them.

Many varieties are unprofitable because of disease.

Many varieties are short-lived due to drouth and disease.

Grapes may be had continuously for seventy-five days by the proper selection of varieties.

Select varieties for succession, using the best for its season.

Do not use too many varieties, as spraying is made more difficult.

Very few black varieties ripen uniform bunches.

Muscadines grow easily and produce heavy crops of fruit at small cost.

Muscadines should have one male vine to each thirty fruit producing vines to insure pollination.

No spraying is necessary for muscadines.

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The Rural Tax Situation In Choctaw County, Miss. 1928

By

LEWIS E. LONG, Research Economist

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi

J. R. RICKS, Director

ACKNOWLEDGMENT

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THE RURAL TAX SITUATION IN CHOCTAW COUNTY, MISS.

By

LEWIS E. LONG, Research Economist

Among the numerous perplexing problems which have confronted farmers for the past ten years has been that of meeting tax payments, which have apparently grown more burdensome year after year since 1920 when post-war deflation set in.

This report deals with the conditions found in one county of the Shortleaf Pine section of Mississippi. Most of the data is for the calendar year of 1928, but, where obtainable with the means at hand, data for former years are shown. The study was undertaken to show, insofar as possible, the contribution of farmers to governmental undertakings and the value of the services rendered in return.

While the study included only one county, it is quite probable that conditions are not greatly different in other counties of Mississippi outside the Yazoo-Mississippi Delta, and even here some of the more common tax problems may be shared.

The statements made in this report are in no manner intended as a reflection on the integrity of the officials or any particular official of the county. If conditions are not such as are desirable, they are due to the present tax system, existing laws and established customs. Some of the subjects discussed may appear trivial in themselves, but it should be remembered that the sum of a multitude of little things can be very burdensome.

If taxes appear high in Choctaw County, the condition is not peculiar to this county or to the state of Mississippi. In Kansas, the tax on farm real estate in 1923 was 2.39 times the average for the years 1910 to 1914. *1 In North Dakota, the tax on farm real estate was estimated to have increased from an average of 23 cents per acre in 1916 to 55 cents per acre in 1922. The estimate for 1924

*1 Bulleain 235—The Trend of Real Estate Taxation in Kansas from 1910 to 1923 p. 17-Kansas State Agricultural College, Manhattan.

was 48 cents per acre or over twice that of 1916. *2 Direct taxes in South Dakota were found to be 2.4 times as high in 1920 as the average for the years 1911-1915. They were only slightly lower in 1925. *3 A study made in Arkansas showed that the amount of state and local taxes in 1926, in relative purchasing power of the dollar, was more than double the amount of 1912. *4 An Oregon study shows an increase of 218 percent in rural taxes from 1910 to 1928. *5 In 1923, the Secretary of Agriculture estimated that the tax on farm property in the United States increased 140 percent from 1914 to 1923, *6 while the country-wide farm tax index of the Bureau of Agricultural Economics was 262 percent of pre-war for 1928. The same bureau estimates that the farm tax level has stood at approximately two and one-half times pre-war since 1923. *7.

Not only have taxes on farm property more than doubled since 1914, but the purchasing power of farm products continues in an unfavorable position, although this condition seems to be gradually improving. The 1928 ratio of prices received by farmers to prices of goods which they purchased at retail averaged 90 percent of pre-war parity which, with the exception of 1925, was the highest annual average since 1920. *8 Taken by months, this ratio stood at 89 for January 1928 from which point it steadily rose to 95 in May when a gradual decline brought the ratio to 86 in December. The trend for the year 1929 was upward.

While purchasing power of farm products generally in the United States was unfavorable, the purchasing power of cotton and cotton seed occupied a better position than other staple crops. Index numbers of prices and purchasing power of cotton and cotton seed (5-year base, August 1909-July 1914 equaled 100) were 152 for January 1928 and 148 for January 1929. The ratios of cotton and cot-

*2 Bulletin 203—Some Tax Problems of North Dakota Farmers—p. 11—Agricultural Experiment Station, Fargo.
*3 Bulletin 232—Taxation and Public Finance in South Dakota—p. 6 Agricultural Experiment Station, Brookings.
*4 Bulletin 223—The Farm Tax Problem of Arkansas—p. 4—Agricultural Experiment Station, University of Arkansas, Fayetteville.
*5 Bulletin 257—Trends of Tax Levies in Oregon with Emphasis upon Rural and City Real Properties—p. 5—Agricultural Experiment Station, Oregon State Agricultural College, Corvallis.
*6 Report of the Secretary, U. S. D. A. Year Book, p. 8.
*7 Circular 101—The Farm Real Estate Situation, 1928-29. P. 6—U. S. Department Agriculture.
*8 The Agricultural Situation. Bureau of Agricultural Economics.

ton seed prices to prices paid by farmers for commodities bought were 99 and 95 respectively for the two periods. *9.

The Setting of the Study

Choctaw is a typical county of what is commonly called the Shortleaf Pine section of Mississippi comprising one-sixth of the total land area of the state. The county lies about 50 miles northeast of the geographical center of the state. The land is generally rolling with a mean elevation of about 450 feet. The soils consist largely of sandy and silt loams and, in their natural state, are ordinarily poor. Liberal applications of fertilizer are necessary for successful crop production. The physical character of the soil is such that, with the rolling terrain and rather heavy rainfall, erosion is marked on unprotected areas.

The average annual rainfall is approximately 52 inches, but because of the nature of the terrain and lack of humus in the soil, drouthy conditions are not uncommon. The average frost-free period is 217 days.

Farming is the principal industry of the county. The 1925 agricultural census showed 1957 farms, a decline of 231 farms from the census of 1920 and 626 farms from the census of 1910. The census of 1900 showed 232 more farms in the county than that of 1925. The 1925 census showed 337 farms as being encumbered with indebtedness. Corresponding figures for preceding census periods were: 393 in 1920, 548 in 1910, 234 in 1900, and 41 in 1890. The high figure for 1910 probably resulted from the occurance of the boll weevil invasion and the decline for succeeding periods is perhaps due to foreclosures, abandonment of farms and liquidation of farm businesses.

The modal size of farms in the county was 50 to 99 acres in 1925 and 1920 and 20 to 49 in 1910 and 1900. The difference is, no doubt, due to the larger number of share cropper operations, which are counted as separate farms, for the earlier periods.

Census data shows that land in farms and land in crops have both steadily declined in Choctaw County by periods since 1910. This decline has been accompanied by a similar decline in numbers of all types of livestock with the exception of mules and chickens. The former shows a slight

*9 Ibid.

increase, but not sufficient increase to offset the decline in horses. Mules and horses, taken together, have declined in number. More chickens were on farms in the county in 1920 than in 1910, but a decrease occurred between 1920 and 1925. The average property values per farm were $1418 in 1925, $2115 in 1920 and $1388 in 1910.

Industries other than agriculture in Choctaw County are small and relatively unimportant. These consist mostly of lumbering operations and related activities. The last federal census for industries gave the county in 1919, twenty-six establishments with a total average of 153 wage earners and a primary horsepower of 970. Wages paid amounted to $106429 and value added by manufacture amounted to $240090. The county is crossed by two railroads, one from north to south and one from northeast to southwest.

The county is populated by home-loving people, who still retain many of the social ideals of a quarter century ago. Camp meeting, with dinner on the ground, is still an annual event in several parts of the county as are also numerous "all-day sings" held at intervals throughout the summer.

The total population, of which 71.6 percent are native white, and the farm population have both decreased by census periods since 1910. The total population, estimated from the 1925 agricultural census, was 12000. The 1920 census gave the county a total population of 12491, of whom 14.8 percent lived in towns or villages. The farm population by census periods was 9424 in 1925, 10942 in 1920 and 13589 in 1910.

Detailed census data are shown in the appendix.

Trend of Taxes in Choctaw County

The trend of taxes have been upward regardless of the measure applied. The sum of the state and county rates increased from 16.75 mills in 1917 to 78 mills in 1928. This increase was not gradual. Slight reductions in the rate were made in 1921, 1923, 1926 and 1927. The 1928 rate was 4.6 times the 1917 rate. It was 23.5 mills higher than the preceding peak of 54.5 mills in 1925, and 33 mills higher than for the preceding year, 1927.

The sum of the state and county rates constitutes the minimum rate for the county with the exception of two

towns. In addition to the levies for the county and the state, there are numerous road and school districts with additional levies. In 1928, four of these districts had total levies of 100 mills or more. Six drainage districts lie wholly or partly in the county. These, with one exception, are financed by a per acre tax which is in addition to the general property tax.

TABLE 1—TAX RATES—CHOCTAW COUNTY—1917-1928

Year	For the County	For the State	County and State
	Mills	Mills	Mills
1917	12.75	4.0	16.75
1918	13.50	5.5	19.00
1919	13.75	5.5	19.25
1920	20.00	9.0	29.00
1921	19.75	9.0	28.75
1922	28.25	8.0	36.25
1923	25.25	8.0	33.25
1924	30.00	8.0	38.00
1925	46.50	8.0	54.50
1926	40.00	6.0	46.00
1927	39.00	6.0	45.00
1928	70.00	8.0	78.00

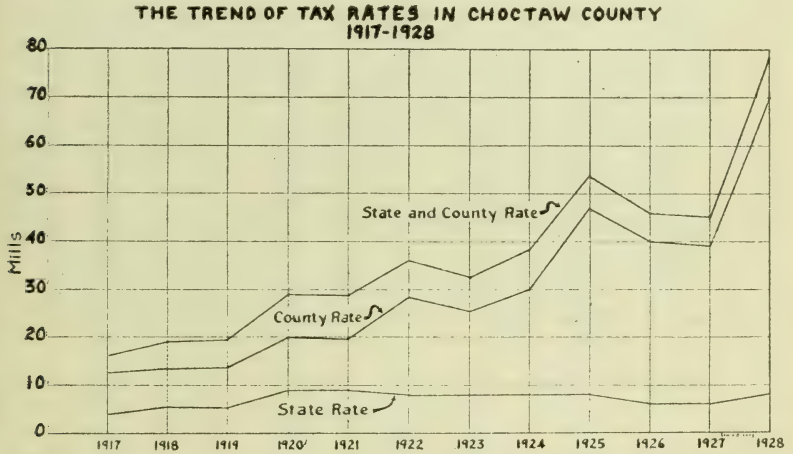


Fig I— In addition to the state and general county rates, there are millage levies by road and school districts and "per acre" taxes for drainage districts. The sum of the millage rates was 100 or more in four districts in 1928.

TABLE 2—RATES OF TAXATION IN THE SEVERAL DISTRICTS—CHOCTAW COUNTY—1928

Political Subdivision	Rate	Political Subdivision	Rate
	Mills		Mills
General County	78	French Camp Road & School	93
Town of Ackerman	74	French Camp School District	83
Town of Mathiston	74	Kenago Road District	85
Town of French Camp	93	Kenago Road & Weir School	93.5
Town of Weir	100	Kenago Road & Chester School	95

	Mills		Mills
Ackerman Road District	84	Weir School District	86.5
Ackerman Road & Fulcher School	88	Weir School & Road	100
Ackerman Road & Mabus School	89	Weir Road District	91.5
Cork Road District	90	Chester Road District	85
Cork Road & Mabus School	95	Chester Road & School	95
Cork Road & Reform School	97	Chester School & Greensboro Road	97
New Prospect Road District	92	Chester School District	88
New Prospect Road & Highpoint School	104	Greensboro Road District	87
Sherwood Road District	84	Chester School & Kenago Road	95
Sherwood Road and School	87	Chester School & Grange Hall Road	92
Sherwood Road & Reform School	91	Grange Hall Road District	82
Sherwood School District	81	Grange Hall Road & Weir School	90.5
Fellowship School District	80	Fentress School District	87
Hebron School District	80	Reform Road District	93
Hebron School & Greensboro Road	89	Reform Road & School	100
Bond School District	79	Reform School District	85
Bond School & Chester Road	86	Reform School & Greensboro Road	94
French Camp Road District	88		

Drainage Districts

District	Rate
Bywy Drainage District No. 1	65 cents per acre
Bywy Drainage District No. 2	75 cents per acre
Yookannakiny District	65 cents per acre
Beech Chitto District	90 cents per acre
Big Black District	80 cents per acre
Webster-Choctaw District	5% of benefits

The numerous total tax rates applying in the county in 1928 are shown in Table 2. These do not include city rates levied by the four towns, but only those applying to taxes collected by the sheriff. The district rate for any district may be obtained by subtracting from it the general county rate of 78 mills which includes the state levy. Thus; for Cork Road District, 90 minus 78 equals 12 mills; for Reform School District, 85 minus 78 equals 7 mills; and for Cork Road and Reform School, 97 minus 78 equals 19 mills (12 plus 7 equals 19).

Assessed valuation turned sharply upward from 1916, when reports of the State Tax Commission first became available, to 1917 after which the rise was more gradual and the peak was reached in 1920. The following decline reached a low point in 1923, rose slightly to 1925, and after a slight dip in 1926, the rise continued to 1928. It seems that valuations are fairly stable, taken as a whole, but certain classes of property tend to fluctuate in value more than others. A glance at Fig. III shows that the rural real estate assessment has shown more fluctuation in the thirteen years covered than any of the other classes. City real estate and railroads and public service corporations appear quite stable, while personal property shows

considerable variation with a marked high point in 1920.

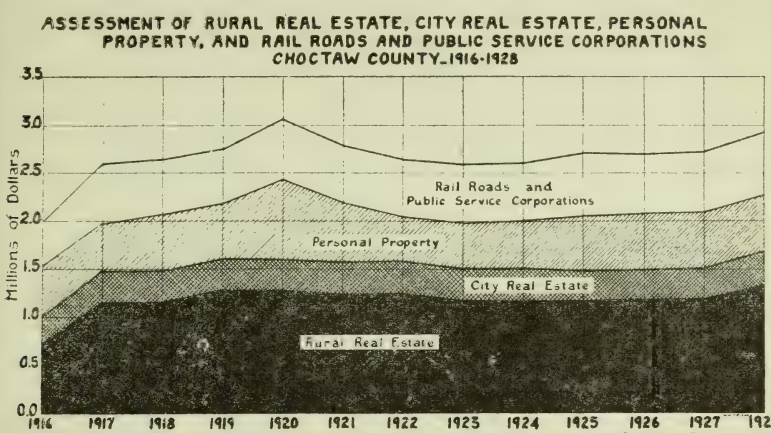


Fig II– Rural Real Estate represents about 45 percent of the total assessed valuation. Personal Property and Rail Roads and Public Service Corporations, together, represent about an equal amount, while City Real Estate represents about 10 percent. The peak was reached in 1920, but the trend is again upward.

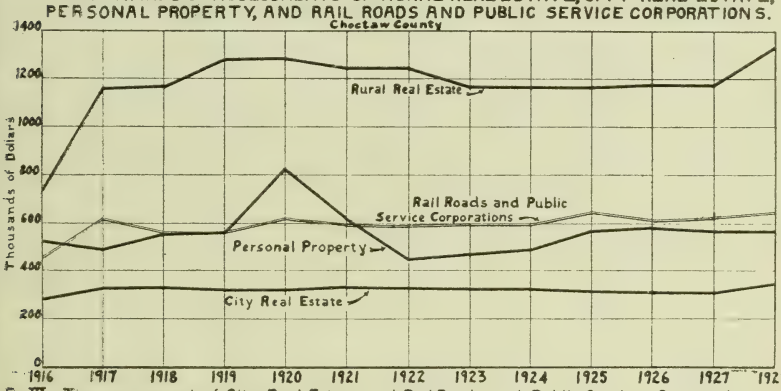


Fig III.– The assessment of City Real Estate and Rail Roads and Public Service Corporations seems to be fairly stable. That of Rural Real Estate and Personal Property shows considerable instability.

On the basis of tax per acre of rural lands, taxes were about four times as high in 1928 as they were in 1917. Taxes per acre, not including timber or improvements, was approximately 7.44 cents in 1917 and 30.44 cents in 1928.

The rural real estate assessment consists of approximately 80 percent land and timber and 20 percent buildings and improvements. The city real estate consists of 25 percent land and 75 percent buildings and improve-

ments. It is impossible to separate personal property into rurally and city owned. It includes all personal farm property not exempt, stocks of goods both manufactured and for manufacture, office equipment, manufacturing machinery, and other numerous items. An itemized assessment for the 13 year period is given in the appendix. The assessment of railroads and public service corporations consists largely of real estate, their office equipment being included with personal property.

While the total assessment and the rate have both increased, there has been considerable decrease in the numbers of things assessed. This has been due partly to tax exemptions. Mules taxed show a decrease from 3837 in 1921 to 2434 in 1928. In 1922, 897 head of cattle were taxed, the largest number since the 1336 of 1916, but in 1928, 294 were taxed, all dairy cattle having been placed on the exempt list. One hundred and thirty-eight oxen were taxed in 1920 and four in 1928. Automobiles showed a steady increase from 38 in 1916 to 1046 in 1928. Office and store fixtures and equipment were assessed at $6780 in 1921, the high point, and at $4670 in 1928. Cultivatable lands amounted to 58957 acres in 1916 and 40278 acres in 1928, a decrease of 18679 acres. Uncultivatable lands, including timber lands, taxed, increased in the same period from 203063 acres to 220791 acres, accounting for 17728 acres of the decrease in cultivatable lands.

This shift from cultivatable land to uncultivatable is due almost entirely to abandonment of fields with no accompanying effort to promote forest growth. The low prices for farm products and the worn out conditions of the soil have placed much of the farm land of the county in the submarginal class. The assessed valuation per acre for cultivatable land is about three times that of uncultivatable which leads farmers to list all possible acreage in the latter class.

TABLE 3—RELATION OF TAXES TO TOTAL INVESTMENT, CHARGES OTHER THAN TAXES, NET EARNINGS AND FARM INCOME; BY SIZE OF FARM. 120 FARMS, CHOCTAW COUNTY, 1928

Item	Size of Farms: Acres						
	To 60	61-140	141-220	221-300	301-380	381-500	All Farms
Farms in group ..... number	8	59	33	9	6	5	120
Average *1							
Size of farm ..... acres	41	103	172	276	339	431	156
Total investment ..... dollars	1427	2678	3121	3481	7698	7457	3227
Value of products ..... dollars	1023	1204	1396	1693	2474	3516	1441

Total charge *2	dollars	665	786	802	1422	1618	2366	937
Net earnings *3	dollars	358	418	594	271	856	1156	504
Val. operator's lab. *4	dollars	298	298	298	298	298	298	298
Farm income *3	dollars	60	120	296	-27	558	852	206
Tax per farm	dollars	50	91	115	184	312	334	122
Relation of taxes to:								
Total investment	percent	3.50	3.40	3.68	5.17	4.05	4.48	3.75
Total charge	percent	7.52	11.58	14.34	12.66	19.28	14.12	13.02
Net earnings	percent	13.97	21.77	19.36	66.42	36.45	29.04	24.21
Farm income	percent	83.33	75.83	38.85		55.91	39.20	59.22

*1 To nearest unit.
*2 Exclusive of interest charges and taxes
*3 Before deducting taxes
*4 Average of values shown in table 5.

TABLE 4—THE RELATION OF TAXES TO TOTAL INVESTMENT, CHARGES OTHER THAN TAXES, NET EARNINGS AND FARM INCOME BY SIZE OF INVESTMENT. 120 FARMS—CHOCTAW COUNTY, 1928

Item		Size of Investment—Dollars							
		To 1000	1001-2000	2001-3000	3001-4000	4001-5000	5001-6000	6001-8000	8001-14000
Farms in group	number	6	33	36	18	9	8	5	5
Average *1									
Total investment	dollars	806	1536	2571	3549	4272	5530	7133	11385
Value of products	dollars	777	834	1217	1579	1660	2481	2538	4590
Total charge *2	dollars	494	572	823	905	1188	1439	1531	2741
Net earnings *3	dollars	283	262	394	674	472	1042	1007	1849
Val. operator's labor *4	dollars	298	298	298	298	298	298	298	298
Farm income *3	dollars	-15	-36	96	376	174	744	709	1551
Tax per farm	dollars	55	76	108	130	139	183	272	304
Relation of taxes to :									
Total investment	percent	6.82	4.95	4.20	3.66	3.25	3.31	3.81	2.67
Total charge	percent	11.13	13.29	13.12	14.36	11.70	12.72	17.77	11.09
Net earnings	percent	19.43	29.00	27.41	19.29	29.45	17.56	27.01	16.44
Farm income	percent			112.50	34.57	79.89	24.60	38.36	19.60

*1 To nearest unit.
*2 Exclusive of interest charges and taxes.
*3 Before deducting taxes.
*4 Average of values shown in table 5.

Taxes and the Ability to Pay

Taxes are not necessarily burdensome because they are high. The tax burden increases only as taxes increase in proportion to the income available for paying. To arrive at an estimate of the tax paying ability of the farmers of the county, a study by the survey method was made of the operation of 120 farms for the year 1928. This was 6.1 per cent of the number of farms shown by the census of 1925, but since the census figures include share cropper units, it is estimated that fully 10 per cent of the independent farm operators were interviewed. The results obtained were carefully checked with census data and data secured in a detailed cost accounting study conducted in the county 1924-1926, and the findings, when allowance is made for difference in racial composition and tenure in the census figures and the economic conditions of the different years, indicate that the farms studied are typical of the white farmers of the county who contribute directly or indirectly

the larger part of the county's finances. Table C of the appendix shows percentage of farms reporting specified crops for the farms studied in 1928 and the farms reported by the census of 1925.

Tables 3 and 4 show abridged financial statements for 120 farms for 1928, grouped by size of farm and size of investment respectively, with the relation of taxes to the different financial items. From Table 3, it appears that taxes in relation to investment are fairly uniform, ranging from 3.40 to 5.17 per cent, and averaging 3.78 per cent with no definite trend as the size of the farm increases. Neither is there a definite trend in the relation of taxes and total charge, or taxes and net earnings. Taxes seem to take a larger per cent of the farm income on the smaller farms than on the larger. Table 5 is a comparable table based on detailed cost records in 1925-26. In this table the trends are upward in all relationships, but this is probably due to the smallness of the sample and the influence of individual farms. Seasonal conditions were much more favorable to farmers of the county in 1925 and 1926 than in 1928 which accounts, in part at least, for the difference in the level of the respective figures.

TABLE 5—THE RELATION OF TAXES TO TOTAL INVESTMENT CHARGES OTHER THAN TAXES, NET EARNINGS AND FARM INCOME

By Size of Farm. 19 Farms Choctaw County—1925 and 1926
From Detailed Cost Accounting Studies

Item	Size of Farms—Acres					
	1925			1926		
	37-100	101-200	201-390	37-100	101-200	200-390
Farms in group .....number	9	7	3	10	6	3
Average *1						
Total investment .....dollars	3134	4296	7267	3228	4646	7046
Value of products.....dollars	1417	1506	2508	1108	1428	2154
Total charge *2 .....dollars	756	854	1566	646	724	1384
Net earnings *3.....dollars	661	655	942	462	704	770
Val. operator's lab. *4....dollars	308	288	383	265	284	340
Farm income *3 .....dollars	353	367	559	197	420	430
Tax per farm .....dollars	50	100	240	54	69	204
Relation of taxes to:						
Total Investment .....percent	1.60	2.53	3.30	1.67	1.49	2.90
Total charge .....percent	6.61	11.75	15.33	8.36	9.53	14.74
Net earnings .....percent	7.56	15.27	25.48	11.69	9.80	26.49
Farm income .....percent	14.16	27.25	42.93	27.41	16.43	47.44

*1 To nearest dollar.
*2 Exclusive of interest charges and taxes.
*3 Before deducting taxes.
*4 At 15 cents per hour.

TABLE 6—RELATION OF TAXES TO TOTAL INVESTMENT, CHARGES OTHER THAN TAXES, NET EARNINGS AND FARM INCOME

By Size of Investment. 19 Farms—Choctaw County—1925 and 1926
From Detailed Cost Accounting Studies

Item		Size of Investment—Dollars				
		1608-3000	3001-4000	4001-5000	5001-7000	7001-8611
1925						
Farms in group	number	3	7	5	2	2
Average *1						
Total investment	dollars	2187	3407	4324	5524	8503
Value of products	dollars	1194	1458	1370	2054	3037
Total charge *2	dollars	563	828	862	1134	1696
Net earnings *3	dollars	631	630	508	920	1341
Val. operator's labor *4	dollars	284	329	286	302	382
Farm income *3	dollars	347	301	222	618	959
Tax per farm	dollars	41	84	73	82	316
Relation of taxes to:						
Total investment	percent	1.87	2.47	1.69	1.48	3.72
Total charge	percent	7.28	10.14	8.47	7.23	18.63
Net earnings	percent	6.50	13.33	14.37	8.91	23.56
Farm income	percent	11.82	27.91	32.88	13.27	32.95
1926						
Farms in group	number	3	8	4	2	2
Average *1						
Total investment	dollars	2305	3357	4320	5709	8515
Value of products	dollars	931	1351	1165	1371	2837
Total charge *2	dollars	443	781	609	679	1795
Net earnings *3	dollars	488	570	496	692	1042
Val. operator's labor *4	dollars	245	269	299	290	361
Farm income *3	dollars	243	301	197	402	681
Tax per farm	dollars	42	61	70	69	266
Relation of taxes to:						
Total investment	percent	1.82	1.82	1.62	1.21	3.12
Total charge	percent	9.48	7.81	11.49	10.16	14.82
Net earnings	percent	8.61	10.70	14.11	9.97	25.53
Farm income	percent	17.28	20.27	35.53	17.16	39.06

*1 To nearest dollar.
*2 Exclusive of interest charges and taxes.
*3 Before deducting taxes.
*4 At 15 cents per hour.

Table 4 shows the same data as shown by Table 3, but with the farms grouped on the basis of size of investment instead of acreage. In this table, there seems to be a downward trend in the relation of taxes to total investment as investment increases, but due to the small number in the higher investment groups, great weight cannot be given this appearance. There also seems to be a similar trend in the relation of taxes to farm income, but this, too, may be misleading because of the small number of farms in the outer groups. Table 6 is a comparable table for a small number of farms in 1925 and 1926. The trend in the relation of taxes to total investment in Table 6 si similar to that in Table 4 if the highest investment group is left off of the former, while the trend in the relation of taxes to net income in Table 6 is opposite that appearing in Table 4.

Perhaps the major showing of these tables is the fact that about 25 percent of net earnings were required for tax payments in a favorable crop year, 1925; about 35 percent

was required in a fair year; and 59 percent was required in a poor year.

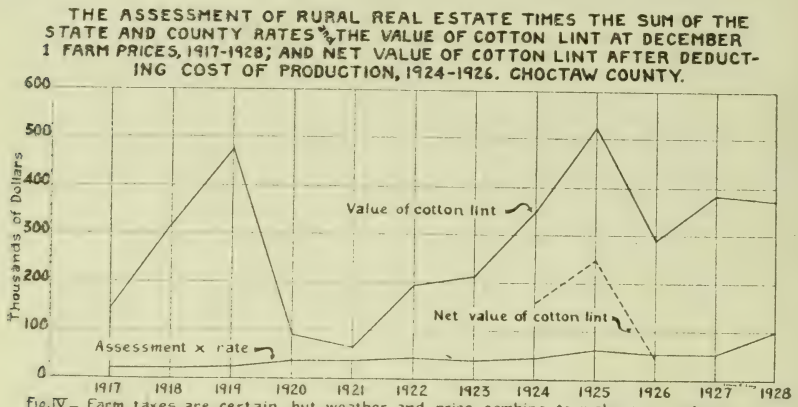


Fig. IV— Farm taxes are certain, but weather and price combine to make crop returns very uncertain. When taxes are high relative to prices received for farm products, they must occasionally be paid out of the farm's capital.

Cotton is by far the outstanding cash crop of the county. With the majority of the farmers it is the only cash crop. From the sales of this commodity the expense of operating the farm, supplying the household and paying taxes must ordinarily be met. Figure IV shows graphicly the value of the cotton lint ginned in the county at the estimated December 1, farm price, and the estimated amount of farm taxes on rural real estate obtained by multiplying the assessment by the rate. This does not show all taxes paid by farmers as the tax on personal property is not included and only the state and general county rates are used. There is scarcely a farm in the county which is not in one or more local districts. Some are in three; school, road and drainage.

The variation in the farmers income from year to year is marked. Seasonal and economic conditions may make or break a farmer in one season where dependence is placed on only one cash crop. In 1920 and 1921, the cotton crops did not return enough to pay taxes after deducting the cash expenses of production, according to farmers reports. In 1926, this condition occurred again on the average of 19 farms by actual cost records. The net returns after deducting costs of production on 19 farms are shown by the short curve in Figure IV.

Taking individual farmers of the county, the individual is rare who has not had on one or more occasions during the past ten years, to get work off the farm, sell off some timber, or borrow at the bank, in order to pay his taxes.

From the data at hand, it appears that neither size of farm nor size of investment appreciably influences the assessment. Much of the land of the county is unproductive and large land holdings are no indication of wealth or undue influence. The investment on the farm in the highest investment group would be considered small in some other sections of the state, and, within the range of the study, the size of the investment seems to have no influence on the assessment.

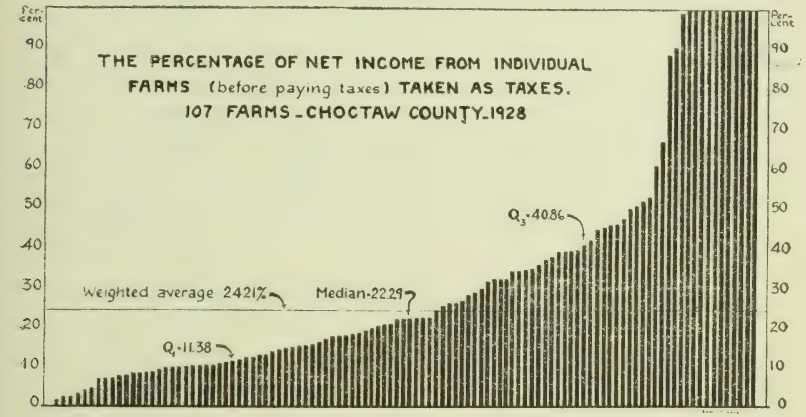


Fig. V.- With the farmer, the ability to pay and the taxes assessed seem to bear no relationship. The 11 farms showing 100 percent of net income paid as taxes lacked an average of $58.13 per farm of breaking even after taxes were paid. Twelve additional farms had an average loss of $261.22 per farm, and more when taxes were included in the operating costs.

TABLE 7—THE RELATION OF ASSESSED VALUES TO FARMERS' ESTIMATE VALUES OF REAL ESTATE—114 FARMS—CHOCTAW COUNTY—1928

Item	Farm Groups—By Size in Acres					
	To 60	61-140	141-220	221-300	301-500	All Fms.
Farms in Group .....Number	8	59	32	8	7	114
Average of Farmers' Estimates						
Size of Farm .....acres	40.8	102.71	172.14	273.75	387.57	147.35
Value of Land .....dollars	442.00	1152.37	1435.66	1451.88	3332.29	1336.91
Value of Timber .....dollars	12.50	46.44	61.72	125.00	314.28	70.31
Value of Improvements ....dollars	500.00	726.69	816.25	878.12	1771.43	810.70
Total Value .....dollars	954.50	1925.50	2313.63	2455.00	5418.00	2217.92
Average as Assessed						
Size of Farm .....acres	40.9	101.83	169.51	278.81	382.14	146.18
Value of Land .....dollars	198.12	447.88	664.22	1056.88	1516.43	599.43
Value of Timber .....dollars		3.39	3.12		114.29	9.65
Value of Improvements ..dollars	131.25	207.97	244.06	346.87	554.28	243.73
Total Value .....dollars	329.37	659.24	911.40	1403.75	2185.00	852.81
Relation of Assessment to Estimates						
Size of Farm .....percent	100.2	99.1	98.5	101.8	98.6	99.2
Value of Land .....percent	44.8	38.9	46.3	72.8	45.5	44.8
Value of Timber .....percent		7.3	5.1		36.4	13.7
Value of Improvements percent	26.3	28.6	29.9	39.5	31.3	30.1
Total Value .....percent	34.5	34.2	39.4	57.2	40.3	38.5

TABLE 8—LUMBER AND RAILROAD TIES SHIPPED FROM POINTS IN CHOCTAW COUNTY—1928

Shipping point	Cars		Amount *1		Value on Stump *2	
	Lumber	Ties	Lumber	Ties	Lumber	Ties
	Number	Number	1000's of board ft.	Number	Dollars	Dollars
Ackerman	170	30	3400	12000	9350	1800
Fentress	2	1	40	400	110	60
Weir	612	..	12240	.....	33660	.....
Reform	17	17	340	6800	935	1020
Total	801	48	16020	19200	44055	2880

*1 Lumber estimated at 20 thousand board feet per car and ties estimated at 400 per car.
*2 Lumber estimated at $2.75 per thousand and ties at 15 cents each.

Studies made in other states and covering the state as a unit have almost invariably found that the more well-to-do persons obtained a proportionately lower assessment than those with a small amount of property, and it is probable that a study on a state wide basis in Mississippi would show similar conditions. Such conditions might be termed a natural result of the general property tax since it is easier to see and assess small properties than large, and property owners of considerable means may have sufficient social and political influence to overawe a rather poorly paid, inadequately equipped, and periodically elected assessor.

Equality of assessment is one of the most important, and at the some time one of the most difficult of attainment, of all the functions pertaining to the general property tax. The wide diversity in the earning capacity of different classes of property and the great increase in what are called intangible properties such as stocks, bonds, and notes have greatly complicated the problem since the early days when farming was the chief occupation of the whole country and tangible property owned was a fair measure of ability to pay.

It is an evident fact that any tax evaded by one individual increases the burden on others. In this connection, it may be said that exemptions on one class of property necessarily increase the tax to be borne by classes of property not exempt, and the practice of making exemptions may lead to conditions quite similar to inequalities in assessment.

According to the laws of Mississippi, property must be listed for taxation at its full cash value—"not what it might bring at a forced sale, but what he(the owner) would be willing and would expect to accept for it if he were dispos-

ed to sell it". It was expected that this basis of valuation would materially aid in a fair assessment for all taxpayers. Numerous inquiries among taxpayers failed to reveal any who claimed to have listed their property at full value. The answers ranged from 50 to 70 percent of full value with the majority clustering closely about 60 percent.

THE RELATION OF FARMERS' ESTIMATES OF REAL ESTATE VALUES TO ASSESSED VALUATIONS. AVERAGES OF 114 FARMS CHOCTAW CO.-1928

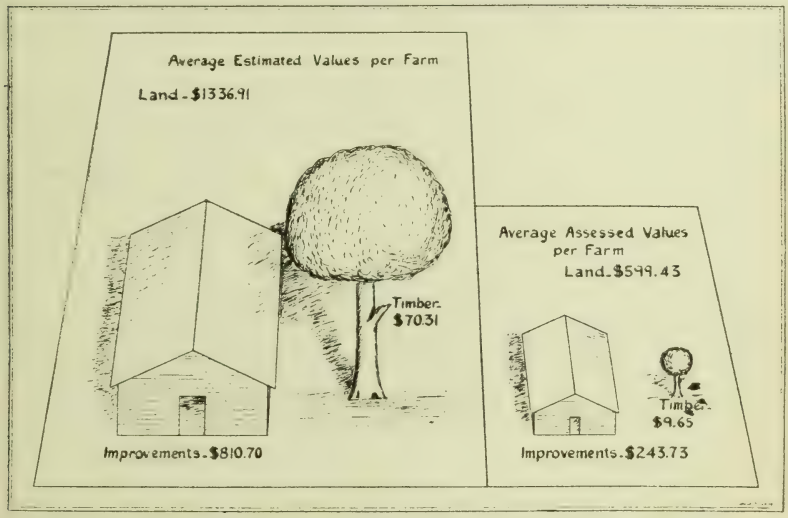


Fig. VI-Land was assessed at 44.8 percent of estimated value on the average, improvements at 30.1 percent of estimates and timber at 13.7 percent of estimates. It is possible that considerable timber escapes taxation.

In order to check on this item, the assessed valuations on the real estate of 114 farms were compared with the owners' estimates. The results are shown in Table 7 and Figure VI. It may be noted that the relation between assessment and the estimated value of land ranged from 38.9 percent in the 61 to 140 acre group to 72.8 percent in the 221 to 300 acre group with an average for all fams of 44.8 percent. Although all groups showed some timber values on the survey schedules, only three groups showed timber assessed.

In this connection, data pertaining to shipments of lumber and railroad ties from the county in 1928 were secured from the railroads operating in the county. This information is shown in Table 8.

While 20,225,000 board feet of lumber was assessed at $41010 in 1927, 16,020,000 feet of lumber and 19,200 railroad ties with a combined total value of $46,935 was shipped from the county in 1928. It is not improbable that a part of the above shipments were assessed as manufactured articles or raw materials for manufacture in 1927. The combined assessment for these two items was $37,460. While forest products, no doubt, constituted the greater part of these items, it can not be assumed that the whole amount was assessed against such products.

On the other hand; it appears that more forest products were hauled from the county to points outside for shipment than were hauled from outside to shipping points within the county. Sturgis, about four miles east of the Choctaw County line, shipped 484 cars of lumber and 53 cars of ties in 1928. McCool, about three miles west of the line shipped 319 cars of lumber and 54 cars of ties. It is more than probable that a part of these shipments originated in Choctaw County. Information as to shipments on the Columbus and Greenville Railroad which parallels the northern boundary of Choctaw County at a distance of a few miles was not obtained nor was such information obtained from points on the Gulf, Mobile ad Northern Railroad, immediately south of Choctaw County.

When these data are considered in the light of the fact that, under favorable circumstances, it requires about fifteen years for a short leaf pine to become large enough to saw and about 20 years to produce a railroad tie from the butt cut, and that the timbered lands of the county are not denuded; it appears that timber is being cut and marketed from land which is being assessed as uncultivatable and much of the timber is not listed for taxation. This condition could be corrected by assessing the land only at regular intervals and assessing the forest products only as they are removed from the land.

For all farms, only 13.7 percent of the owners' estimates of the value of the timber was listed for assessment. Improvements for all farms were assessed at 30.1 percent of the owners' estimates of full value with a range by groups from 26.3 to 39.5 percent. All real estate for all farms was assessed at 38.5 percent of estimated value with a range by groups from 34.2 to 57.2 percent. On the basis

of individual farms, ranges were somewhat greater than by groups in all relations. While it appears that the 221 to 300 acre group was assessed at higher valuations than other groups, the appearance is perhaps incidental. The small number of farms in the group is insufficient to justify a conclusion. The fact that taxpayers have different ideas of what constitutes a fair valuation makes inequalities possible both as between individuals and between counties.

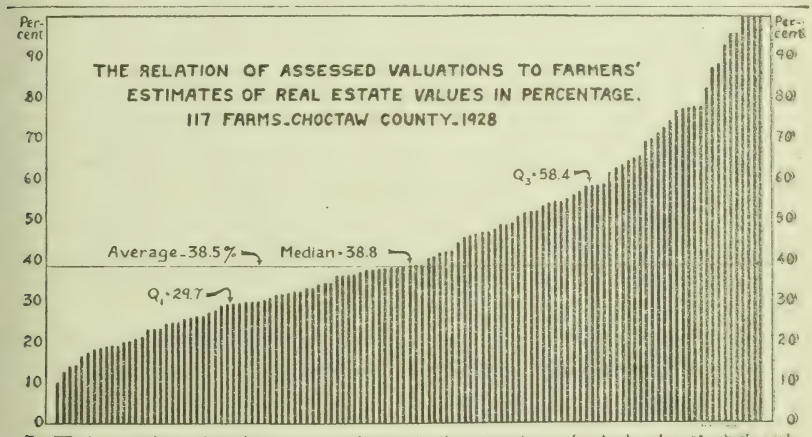


Fig. VII.—It is evident that there is no uniformity in the percentage of actual value at which real estate is assessed. Such a condition is inevitable where each owner is the judge, not only of the actual value of his farm, but also of the amount at which it is assessed.

TABLE 9—REAL ESTATE—RELATION OF SALE PRICE TO ASSESSED VALUATION CHOCTAW COUNTY, MISSISSIPPI—1928

Acres	Sale price-a	Assessed Valuation				100 b / a
		Land	Timber	Buildings	Total-b	
Number	Dollars	Dollars	Dollars	Dollars	Dollars	Percent
80	500	240			240	48
160	2000	1280		320	1600	80
40	400	185			185	46
22.5	150	90			90	60
79	500	265		50	315	62
120	1200	425		150	575	48
5	500	50		275	325	65
110	500	515		250	765	153
80	300	240	50		290	97
40	150	120			120	80
80	200	300		200	500	250
80	1000	320	500		820	82
30	100	90			90	90
117	1400	470		100	570	41
80	700	320		100	420	60
80	300	280			280	93
80	600	370		250	620	103
120	350	360			360	103
2 town lots	100	40			40	40
320	4000	1040	1000	50	2090	52
88	1350	350			350	26
160	750	680	150	150	980	131
80	600	300		100	400	67
				Weighted Average		98

TABLE 10—REAL ESTATE—RELATION OF SALE PRICE TO ASSESSED VALUATION WHERE ASSESSED UNIT CONSTITUTES MORE OR LESS OF UNIT SOLD CHOCTAW COUNTY, MISS.—1928

Sale		Assessment			
Acres Number	Value Dollars	Acres Number	Land Dollars	Buildings Dollars	Total Dollars
1 city lot	750	8 lots	200		200
20	200	60	250		250
40	500	80	380		380
40	100	114	430	50	480
20	500	102.5	455	300	755
70	600	80	345	100	445
20	100	40	120		120
40	400	140	515	250	765
80	1800	272	1330	100	1430
123	600	143	590		590
100.5	1000	90	275	125	400
40	300	200	720	150	870

NOTE: There is no way of knowing whether the buildings were on the part sold or not.

As a further check on the ratio between assessed and actual values, a study was made of the real estate transfers as shown by the county records for 1928. One hundred and fifteen real estate transfers occurred in the county during the year, but after eliminating those where "love," "affection" and "other valuable considerations" constituted a part of the payment, only 35 remained. Of these, 12 sales involved either more or less than the parcels as assessed and 23 could be definitely identified on the assessment records.

The 23 parcels with sale price and assessed valuation are shown in Table 9. In this table, the relation of assessed valuation to sale price ranges from 26 to 250 percent, averaging 68 percent. Even if those above 100 percent were discarded, the average would remain above 50 percent which indicates that the estimates of the 114 farmers as shown in Table 7 may have been too high. Table 10 shows the relation of sale price to assessed valuation on 12 properties where the parcel sold was more or less than that assessed. It further bears out the conclusion that rural real estate is not assessed at more than about 60 percent of its actual value in the county. Because of the fact that the county is typically rural, with no large towns and few industries, no effort was made to compare the assessment of rural and urban properties.

Tax Delinquency

In spite of the fact that taxes have been comparatively high for several years past and took on a sharp rise in 1928, delinquency has not been great. On August 1, 1929, the

total number of delinquent tax accounts in the county was 1945. These included, in addition to the ad valorem tax, communtation road taxes, poll taxes and dog taxes, and were owed by 1755 persons.

The ad valorem delinquent accounts involved 91 pieces of real estate—76 rural and 15 urban. Road and poll taxes are assessed against negroes as well as whites who come within the age limits, but, as many negroes have no taxable property and, therefore, do not report at the courthouse for property tax payments, and, as they do not value tax receipt as qualifying, instruments in elections, the negro often allows these taxes to become delinquent. Since the amount per person so delinquent is not great, being two dollars for poll, five for road or seven for both, little effort is made for collection of all accounts. Dogs were assessed in 1928 at $1 each for males and $2 each for females.

In the case of real estate, only 91 delinquents occurred out of 3898 persons assessed for this item. Rural real estate was assessed to 3230 persons and urban real etate to 535 persons. Some persons, of course, are counted twice, being assessed for both urban and rural properties. Of the 91 delinquencies, August 1, 1929, 76 were on rural property and 15 on urban property. Of the rural properties, 39 reverted to the state and 37 were purchased by individuals. Of the urban properties, the state acquired 6 properties and individuals 9. Ten of the rural properties were subsequently redeemed prior to December 1, 1929. With taxes remaining at the 1928 level, however, it is probable that real estate tax delinquencies will become a serious problem within a few years.

The Receipts of Choctaw County

The revenue and non-revenue receipts of the county for the year ending September 30, 1928, are shown in Table 12. They are shown graphicly on a percentage basis in Figure VIII.

The greater part of the county funds was obtained from the General Property tax as might be expected, but almost an equal amount in the nature of temporary loans was obtained. As has been previously indicated, the General Property tax falls heaviest on agricultural interests partly because of the predominance of agriculture in the county and partly because of the possibility of business con-

cerns shifting their taxes forward or backward to the farmers.

REVENUE AND NON-REVENUE RECEIPTS OF CHOCTAW COUNTY FOR YEAR ENDING SEPT. 30, 1928. BASED ON UNIFORM ANNUAL REPORT.

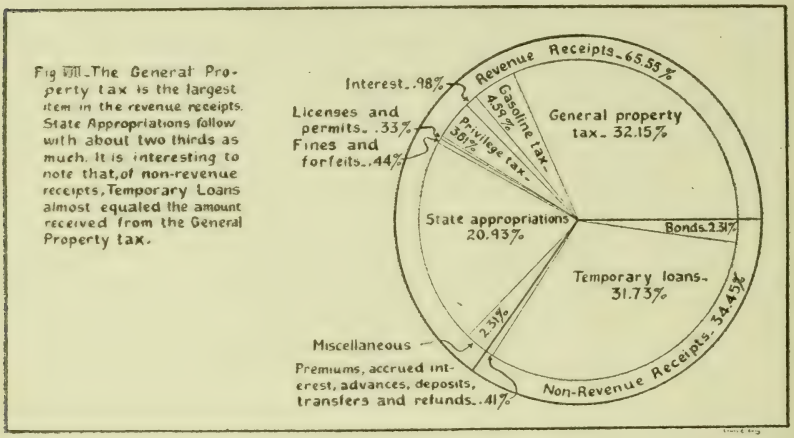


Fig VIII-The General Property tax is the largest item in the revenue receipts. State Appropriations follow with about two thirds as much. It is interesting to note that, of non-revenue receipts, Temporary Loans almost equaled the amount received from the General Property tax.

According to the State Auditor, (Table F, Appendix) there were 393 concerns doing business in the county in 1928. Of these, a considerable number were farmers who were conducting such business operations as a sideline. The more common kinds of business paying state privilege taxes, together with the numbers of each, were: stave factories, 78; gas pumps, 49; cigarette dealers, 29; handling non-alcoholic drinks, 27; coca-cola dealers, 24; saw mills, 19; auto accessories, 14; auto repairs, oil depots, and physicans, 12 each; and oil wagons and soda fountains, 10 each. Privilege taxes from business concerns are also collected by the county. They are shown as Licenses and Permits and yield a small amount. The privilege tax item in Table 12 comes from the licensing of automobiles and trucks.

While revenue from the gasoline tax is not large, it is capable of being materially increased as roads are improved. The county has only a few miles of all-weather roads at present so that cross county travel is not great. When the county road building program is completed, the gasoline tax should yield much more revenue.

Interest on balances amounted to 52 percent of the amount paid as interest on temporary loans. This item is relatively unimportant, but it might be increased somewhat

by reducing the number of separate accounts so that banks could reduce the cost of handling the funds and bid a higher rate for the depository contract.

TABLE 11—TAX ACCOUNTS DELINQUENT IN CHOCTAW COUNTY—AUGUST, 1929

Kind of tax	Delinquent Accounts	Delinquent Valuation
	number	dollars
Ad valorem	102	9758
Commutation road	142	710
Poll	1651	3302
Dog	50	59
Total	1945	13829

TABLE 12—COPY OF UNIFORM ANNUAL REPORT FOR YEAR ENDING SEPTEMBER 30, 1928. CHOCTAW COUNTY, MISSISSIPPI

Revenue Receipts	Amount	Governmental Costs	Amount
	Dollars		Dollars
General Property Tax	97266.60	Administrative	9624.79
Gasoline Tax	13885.25	Judicial	3655.76
Privilege Tax	11515.05	Prot. of Person & Property	680.20
Interest	2966.48	Conservation of Health	540.00
Rents	none	Highway Maintenance	98556.53
Licenses and Permits	996.50	Charities and Corrections	512.00
Fines and Forfeits	1343.00	Educational	84874.95
State Appropriations	63333.13	Miscellaneous	2509.52
Departmental Earnings	none	Interest on Temporary Loans	5700.00
Sales of Property	105.00	Interest on Bonds	31372.00
Miscellaneous Receipts	6928.59		
Total Revenue Receipts	198339.60	Total Governmental Costs	238025.75
Non-Revenue Receipts		**Non-Governmental Costs**	
Temporary Loans	96000.00	Temporary Loans	21000.00
Bonds	7000.00	Bonds	12500.00
Prem. & Accrued Interest	210.00	Permanent Improvements	116361.88
Advances and Deposits	388.19	Transfers and Refunds	none
Transfers and Refunds	638.86	Trust & Invest. Transactions	none
Trust & Investment Transactions	none		
Total Non-Rev. Receipts	104237.05	Total Non-Governmental Costs	149861.88
Total Receipts	302576.65	Total Disbursements	387887.64
Bal. on hand, beg. of period	132328.75	Bal. on hand, end of period	47017.76
Grand Total	434905.40	Grand Total	434905.40

Fines and forfeits yield a variable revenue and cannot be considered for budgetary purposes.

State appropriations, the second largest item in revenue receipts is an important source of income for counties with little taxable wealth. The grand total assessment for the county in 1928 multiplied by the state rate of 8 mills gives a calculated figure of $23199 as state property taxes paid in the county. It will be seen that nearly three times as much was returned to the county as was collected on the 8 mill property tax. This source of revenue will be discussed further under the general heading of "Costs".

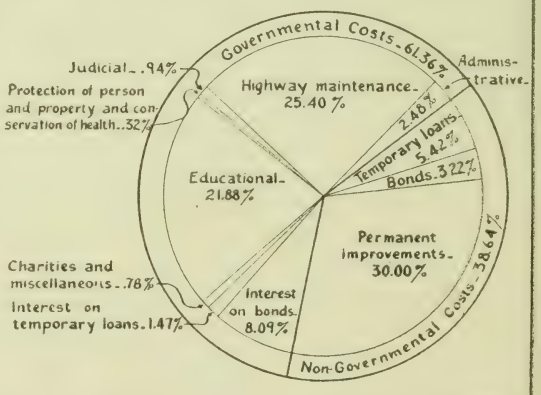
Temporary loans constitute the outstanding item of non-revenue receipts. This item is usually, but not always, evidence of miscalculations in preparing the budget. Large

temporary borrowings not only call for larger interst payments, but often they create a feeling among taxpayers that the public business is not being managed with the maximum efficiency. Where the public expenses are carefully controlled to hold them within the financial means of the county, temporary borrowing is necessary only occasionally. These occasions may be, first, to meet expenses pending the receipt of delayed tax collections or sale of bonds, and second, for the replacement of public property destroyed by fire, or other calamity. Where temporary loans reach a large amount and repayment is impossible short of several years it is ordinarily economical to float bonds and pay off the loans with the proceeds where the law permits of such bond issues.

Temporary loans of $96,000.00 in 1928 were reduced during the year by $21,000.00, leaving a balance unpaid of $75,000.00. For the year ending September 30, 1929, temporary loans were secured amounting to $26,916.50 and

GOVERNMENTAL AND NON-GOVERNMENTAL COSTS OF CHOCTAW CO.
FOR THE YEAR ENDING SEPT. 30, 1928, BASED ON UNIFORM ANNUAL REPORT.

Fig IX-Of the governmental costs, highway maintenance constitutes the largest item, followed by cost of education. The greater part of the non-governmental costs went for permanent improvements, represented chiefly by road construction. As more permanent roads are built, the cost of highway maintenance should show a decrease. Better roads should also tend to lower transportation costs of education if the present educational standards are not raised.



repayments were made of $68,639.11. The net amount of temporary loans at the latter date may be calculated as $33,297.41, a substantial reduction and indicative of good management on the part of the county officials.

TABLE 13—TOTALS BY QUARTERS OF THE COUNTY DEPOSITORY'S ACCOUNT WITH CHOCTAW COUNTY, WITH SUMMARY—1928

Quarter ending appropriately	Separate Funds	Balance Last rep.	Interest	Deposits	Coupons Paid	Warrants Paid	Balance This rep.
	Number	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
March 31	75	156585.67	1050.71	147711.86	1595.00	111994.58	191758.66
June 30	73	191573.66	1166.32	130827.55		245275.55	78291.98
Sept. 30	73	77916.81	293.65	19448.08	1050.22	50541.65	46066.67
Dec. 31	81	46254.56	208.62	74136.15	1192.50	69161.28	50245.55

Summary

Debits		
Balance January 1, 1928		$156585.67
Interest		2719.30
Deposits		372123.64
Total Debits		$531428.61
Credits		
Coupons Paid	$ 3837.72	
Warrants Paid	476973.96	
*1 By Error	372.28	
Balance December 31, 1928	50245.55	
Total Credits		$531428.61

*1 The data for the above table was assembled from the minute book of supervisors' meetings. The minutes had, in turn, been copied from bank statements. It is assumed that this item results from errors in copying.

Receipts from bonds amounted to only $7,000.00 in 1928. This form of revenue should be obtained only for the purpose of making permanent improvements except as in the case of making the best of a bad situation cited above where a bond issue is suggested for funding temporary loans in order to get the benefit of lower interest rates. Where bonds are sold to finance permanent improvements, care should be taken that the improvement last until the last of the bond issue is retired.

The other sources of non-revenue receipts are relatively unimportant.

In connection with receipts, mention was made of a number of separate accounts handled for the county by the county depository. The common practice is to deposit the county's funds with the bank offering the highest rate of interest on balances, safety of principal taken into consideration. Table 13 shows approximately the county's financial condition by quarters for 1928. The figures are only approximate, being subject to errors of copying. An accurate audit was not attempted either of these data or other data used in this report.

The chief point of interest in Table 13 is the large number of separate accounts, ranging from 73 to 81 during the year. Some of these consisted of only a few dollars and were neither added to nor reduced during the year. Such

a condition necessitates much bookkeeping on the part of the bank, and is doubtless considered when bidding for the custody of the county funds. The condition is also conducive to borrowing from one fund to build up another, a practice involving much bookkeeping and sometimes resulting in tangled accounts which are difficult to straighten out.

Governmental and Non-governmental Costs

It will be seen from Table 12 that all governmental cost items appear small compared to Highway Maintenance, Educational, and Interest on Bonds. Of non-governmental costs, Permanent Improvements is the outstanding item. Figure IX shows the governmental and non-governmental cost items on a percentage basis.

TABLE 14—COUNTY BUDGET—1928—CHOCTAW COUNTY

Item	As amended by the Board April meeting	As shown in the Sept. minutes
	Dollars	Dollars
Expenses of Sheriff's Office	2500	2000
Expenses of Chancery and Circuit Clerks	2200	1200
Expenses of Superintendent of Education	2850	350
Board of Supervisors	7000	5000
Salary, Attorney of the Board	600	600
Salary and Expenses of Tax Assessor	2200	1500
Salary and Expenses of County Health Officer	1250	750
County Poor Home	1500	1000
Ex. Officia, State Failures, etc., Sheriff	700	300
Ex. Officio, State Failures, etc., Justices of the Peace and Constables	900	600
Expenses of Circuit Courts	4000	5000
Expenses of Chancery Courts	350	400
County Auditor, Assessment Rolls, Per diem, etc.	2000	2500
Circuit Clerk, County Registrar, Per diem, State Failures, etc.	1675	1000
Court House and Jail	1000	1000
Miscellaneous, Donations, etc.	7000	1000
Bridges, Pikes, Lumber, Nails, etc.	30000	20000
Road Purposes	100000	50000
To repay borrowed moneys	10600	75000
School Purposes (Excluding towns of Ackerman and Mathiston)	30000	45000
Interest and Sinking Fund, Ackerman Road District	6000	6000
Interest and Sinking Fund, Chester Road District	1300	1300
Interest and Sinking Fund, Cork Road District	500	500
Interest and Sinking Fund, Fentress Road District	1000	1000
Interest and Sinking Fund, French Camp Road District	900	900
Interest and Sinking Fund, Greensboro Road District	1200	1200
Interest and Sinking Fund, Grange Hall Road District	500	500
Interest and Sinking Fund, Kenago Road District	900	900
Interest and Sinking Fund, New Prospect Road District	1000	1000
Interest and Sinking Fund, Reform Road District	1600	1600
Interest and Sinking Fund, Sherwood Road District	1250	1250
Interest and Sinking Fund, Weir Road District	4500	4500
Choctaw Bond Issue (Road) Interest and Sinking Fund	28000	28000
County Agent		2000
Agricultural High School		6000
Totals	257685	270850

Revenue Received for 1927

Common County Purposes	15560
School Purposes	80000
Road Purposes	50000
Bonded Roads	50000
Bridges, Pikes, Lumber, Nails, etc.	25000
Total	200500

TABLE 15—MISCELLANEOUS GOVERNMENTAL EXPENSES, BLLS ORDERED PAID BY THE BOARD OF SUPERVISORS FEB. 8 . 1928. TO JAN. 7. 1929 BY QUARTERS CHOCTAW COUNTY, MISSISSIPPI.

Item	Feb. Mar. and April	May, June and July	Aug. Sept. and Oct.	Nov. Dec. and Jan.	Total for 12 months
	Dollars	Dollars	Dollars	Dollars	Dollars
Salaries	2083.56	3277.30	2472.94	2424.03	10257.83
J. P. & Constable Fees	160.05	6.00	169.70	48.10	383.85
Sheriff and Prisoner cost	325.40	381.16	507.39	236.00	1449.95
Jury services	24.00	24.00	13.00	25.50	86.50
Audits & Clerk service	175.60	254.63	200.00	211.00	841.23
Supervisor's Meetings	952.00	204.00	383.00	94.00	1633.00
Elections	212.00	19.00	27.00	146.00	404.00
Court Costs	208.10	148.15	40.59	24.80	421.64
Freight, Express & hauling	48.65	4.60	205.10	17.72	276.07
Building upkeep *1	101.12	818.13	379.42	409.38	1708.05
Insurance	87.00	42.50	34.00		163.50
Printing	790.62	361.86	283.78	1234.34	2670.60
Postage	33.40	29.35	41.50	48.65	152.90
Advertising bonds	133.66	100.13	50.02	31.86	315.67
Lights and water	37.42	37.65	58.22	96.90	230.19
Telephone service	82.25	83.50	33.05	22.85	221.65
Fuel	43.43		56.69	54.65	154.77
Supplies	159.50	256.60	577.89	79.50	1073.49
Merchandise	235.37	214.43	364.15	239.51	1053.46
Damages *2	25.00	640.00	2021.66	1000.00	3686.66
Refunds, Taxes & fines	304.54	685.13		61.65	1051.32
School aid		818.42		40.04	858.46
Poor relief	570.36	351.60	236.75	300.04	1458.75
Unitemized	633.24	29.86		89.00	752.10
Note Redemption	1015.00	20416.61			21431.61
Totals	8441.27	29204.61	8155.85	6935.52	52737.25

*1 Labor and materials.
*2 Principally for highway right of way.

An effort was made to obtain these cost in detail and to measure the benefits received by the people of the county in return for the taxes paid. Due to the method of bookkeeping, this was found to be quite difficult, and it seems that the introduction of modern accounting methods in county government which would enable a citizen to tell at all times just how the county stands in its fiscal affairs would be a great improvement. Some headway has been made in this direction since this study was begun by the establishment of a warrant disbursement register and the auditing of county records.

In discussing costs, items may be mentioned which in themselves appear trivial, but a large number of such items taken together may constitute a real burden.

One of the important functions of the Board of Supervisors is the preparation of the county budget. Such a bud-

get as adjusted in April from the budget of the preceding September, and prepared in September, 1928, is shown by Table 14. The grasp which the Board has on the county's business affairs is indicated by the accuracy with which the budget conforms to actual costs and the public funds. An effort was made to make such a comparison, but lack of familiarity with the numerous separate accounts and the fact that the county's fiscal year ends September 30, while costs taken from the minute book cover the calendar year made this impossible. The costs were, therefore, roughly divided into Miscellaneous Governmental Expenses, Expense on Roads and Bridges, and School Expenses. As the items appeared in the minute book promiscuously, it was not attempted to classify them in conformity to cost items shown in Table 12.

Table 15 shows a group of miscellaneous expenses incidental to the functioning of county government. Most of them are clear. A few items, however, need further explanation. Salaries do not include all payments made to employees. A number of officers are empowered to collect and retain fees in addition to salary as shown by Figure X. Lack of uniformity between quarterly salaries is due to irregularity in payments. In addition to Justice of the Peace and Constable fees, small annual salaries were paid.

TABLE 16—EXPENSES ON ROADS AND BRIDGES, BILLS ORDERED PAID BY THE BOARD OF SUPERVISORS FEB. 8. 1928. TO JAN. 7. 1929 BY QUARTERS—CHOCTAW COUNTY, MISSISSIPPI

Item	Feb. Mar. and April	May, June and July	Aug. Sept. and Oct.	Nov. Dec. and Jan.	Total for 12 months
	Dollars	Dollars	Dollars	Dollars	Dollars
Labor and teams	18453.98	11359.67	15244.72	10817.06	55875.43
Materials	12396.94	5132.05	4676.02	3833.32	26038.33
Gas, Oil & Grease	5857.40	6424.88	4500.18	4459.73	21242.19
New Equipment & Rep.	6341.96	8623.26	2475.21	4192.64	21633.07
Travel, Express, Freight and Hauling	230.80	19.64	319.79	36.47	606.70
Inspection services	876.00	1090.00	996.00	318.00	3343.00
Interest and Principal on Bonds	19933.28	1336.43	10122.79	5042.20	36434.70
Unitemized	586.25				586.25
Road Construction—State H. W. Dept.		116361.88			116361.88
Totals	64676.61	150347.81	38334.71	28762.42	282121.55

Sheriff and prisoner cost is only a small part of the cost of the sheriff's services. The sheriff's office is on a fee basis and, according to report filed with the Secretary of State and made public, it returned a net sum for the month of December, 1928, of $2017.94. The net amount for the

year 1929 was $6760.00. This item of cost will be discussed at greater length under another heading.

THE PRINCIPAL OFFICIALS OF CHOCTAW COUNTY, MISSISSIPPI, WHETHER ELECTED OR APPOINTED, TERM OF OFFICE AND HOW PAID.

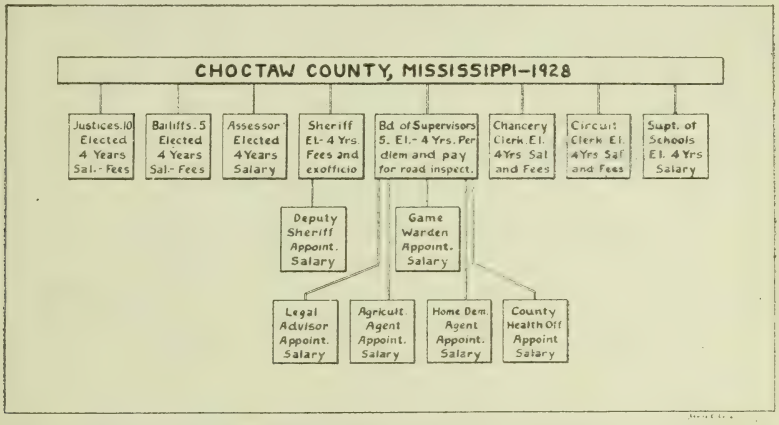

CHOCTAW COUNTY, MISSISSIPPI—1928
Justices. 10 Elected 4 Years Sal.- Fees
Bailiffs. 5 Elected 4 Years Sal.- Fees
Assessor Elected 4 Years Salary
Sheriff El. 4 Yrs. Fees and exofficio
Bd. of Supervisors 5. El.- 4 Yrs. Per diem and pay for road inspect.
Chancery Clerk El. 4 Yrs Sal and Fees
Circuit Clerk El. 4 Yrs Sal and Fees
Supt. of Schools El. 4 Yrs Salary
Deputy Sheriff Appoint. Salary
Game Warden Appoint. Salary
Legal Advisor Appoint. Salary
Agricult Agent Appoint. Salary
Home Dem Agent Appoint. Salary
County Health Off Appoint Salary

Fig. X.-In addition to the principal officials, there are appointments of deputies for short periods, road maintenance crews, janitors and stenographers; all on a salary basis.

The item for supervisors' meetings does not include the cost of road inspection amounting to $3343 which is included in expense on roads and bridges, Table 16.

Merchandise may cover a large variety of items. To avoid the possibility of suspicion, all articles paid for should be named in the minute book. While a county may use merchandise not classified as office supplies, no doubt should remain in the taxpayer's mind as to what he is paying for. The same may be said of the unitemized payments. A payment entered simply as "John Doe—$20.00" without saying what the payment was for is open to question. The method of entering these two items in the books has been corrected in Choctaw County since this study was begun. They are mentioned here as suggestions to clerks of other counties.

Expenses on Roads and Bridges

As has been shown, more of the tax dollar is expended on roads than on any other one item. Table 16 shows by items the amounts expended in 1928 for roads and bridges. Road maintenance, inspection and new construction are included. Of the total amount, $116,361.88 was used for

new construction, $36,434.70 was used to pay interest and principal on bonds and $21,633.07 was used for new equipment and repairs. The remainder, $129,324.97, is considerably greater than the item of road maintenance cost in Table 12 which may be accounted for by the different periods of time covered. It corresponds approximately to the sum of the items for road purposes, exclusive of interest and sinking funds, shown by the budget, Table 14.

The system followed in the county is to let the working of roads by contract, the county furnishing the machinery and, where mechanical power is used, the fuel and oil. The first item, Table 16, represents the sum paid for labor and teams used in road maintenance with perhaps a small amount of new construction in the form of replacement of bridges, building up grades and bridge approaches, alteration of rights of way and blacksmithing. With the exception of the last item which represents new construction, this is the largest single item.

Materials consisted largely of lumber, nails, and culverts. A part of the lumber was purchased in the form of logs, the county having them sawed. Where this was done, it was not always possible to isolate the sawing charge so that a part of this charge may be included with labor and teams.

All bills paid to filling stations were considered as for gasoline, oil and grease, although these were not always specified. Where the filling station operator kept a repair shop, items of repair were, no doubt, included.

A total of $21,633.07 was expended during the year for new equipment and repairs. It appears that expenditures for these items were somewhat heavier than usual since road machinery and equipment belonging to the county was inventoried at $20,000.00 October 1, 1929. It would seem that such equipment must have been almost entirely replaced in 1928. Under the present system, each supervisor is responsible for the equipment used in his beat and equipment is moved from one beat to another only by agreement between the respective supervisors.

The item for travel, express, freight and hauling needs little explanation other than to say that the hauling refers mostly to transfer of freight rather than to hauling incident to road and bridge construction, although a few of the lat-

ter items may be included.

Inspection services are performed by the members of the Board of Supervisors for which they receive pay. This item differed considerably among the different beats for the year.

Interest and principal on bonds constituted the second largest item other than new construction. This item will continue to increase for a number of years at best. Table 17 shows the bonded indebtedness of the county as of September 30, 1928. After deducting $341,000.00 of the county wide issue and $23,800.00 of jail and school bonds, $186,-500.00 of bonded indebtedness remain to 14 local road districts. The first of these bonds was issued in 1916 and the last in 1920. The first retirement began in 1927 and the last will be retired in 1944, if the present plan is followed and no bonds are repudiated.

THE PERCENTAGE DISTRIBUTION OF EXPENSES ON ROADS AND BRIDGES— CHOCTAW COUNTY—1928.

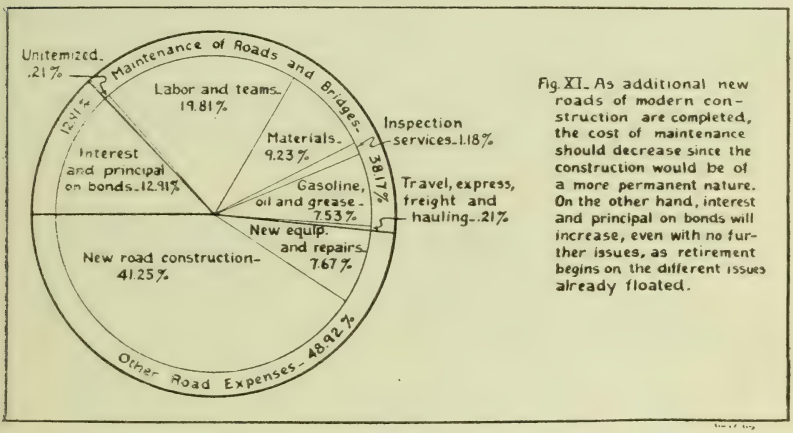


Fig. XI—As additional new roads of modern construction are completed, the cost of maintenance should decrease since the construction would be of a more permanent nature. On the other hand, interest and principal on bonds will increase, even with no further issues, as retirement begins on the different issues already floated.

TABLE 17—OUTSTANDING BONDED INDEBTEDNESS OF CHOCTAW COUNTY AND ITS SUBDIVISIONS *1—SEPTEMBER 30, 1928

Name	Principal	Rate	Date of Issue			Maturity	
	Dollars	Percent	Mo.	Day	Year	Year	Year
Jail building	8000	6	Jan.	2,	1911	1921	1931
Weir Road District	13000	6	Nov.	1,	1916	1927	1936
Ackerman Road District	25000	6	Nov.	1,	1916	1928	1941
Fentress Road District	7000	6	Nov.	1,	1917	1928	1937
Ackerman Road District	15000	6	Nov.	1,	1917	1928	1942
Cork Road District	6000	6	Feb.	1,	1918	1929	1939
Sherwood Road District	13000	6	Aug.	1,	1918	1929	1938
Reform Road District	10000	6	Jan.	1,	1919	1930	1940
Reform School District	4000	6	March	1,	1919	1932	1939
New Progress Road District	13500	6	June	1,	1918	1929	1940
Weir Road District Addition	19000	6	July	1,	1919	1931	1932
Greensboro Road District	10000	6	June	1,	1919	1930	1939
Chester Road District	17000	6	Aug.	1,	1919	1934	1944
Kenego Road District	10500	6	Aug.	1,	1919	1934	1944
French Camp Road District	13000	6	Aug.	1,	1919	1933	1941
Grange Hall Road District	4500	6	Nov.	1,	1919	1938	1938
Reform Road District	10000	6	June	1,	1920	1935	1944
Weir School	3000	6	June	5,	1922	1925	1938
Highpoint School District	1800	6	July	10,	1922	1928	1937
Choctaw County Bonds (Road)	341000	5.5	April	1,	1925	1926	1950
Chester School District	7000	6	May	7,	1928	1924	1952
Total Bonded Indebtedness	551300						
Temporary loans	96000						
Total Indebtedness	8647300						

*1 From official report.

It is worthy of note that these bonds were issued during years of high prices when a feeling of general prosperity was much in evidence. The year 1916 saw two issues; 1917, two; 1918, three; 1919, seven; and 1920, one. It will be recalled that the agricultural depression which has continued to the present time, started in the fall of 1920. In the matter of local road bond retirements; one started in 1927; three in 1928; three are to start in 1929; six in 1930; one in 1931; and one in 1935.

From the county wide bond issue of 1925, approximately 24 miles of properly graded and graveled road has been constructed as a part of the state highway system. The total mileage of roads in the county is given in the inventory of October 1, 1929 as 600 miles of which only the above 24 miles may be considered as an all-weather road. The inventory value of the above roads was $900,000.00 to which may be added $50,000.00, the value of bridges, making a total of $950,000.00. This figure means very little since the value of a road may best be determined by the degree to which it meets the needs of the community. Measured by this standard, many of the roads of the county are without value during protracted rainy seasons as they become impassable. If we take this valuation, however, together

with $129,324.97 which appears to be the annual cost of maintenance, the annual maintenance cost is found to be 13.6 percent of the value. This means that the entire investment is replaced every 7.4 years, a condition that no business other than a public enterprise could stand.

CHOCTAW COUNTY ROADS

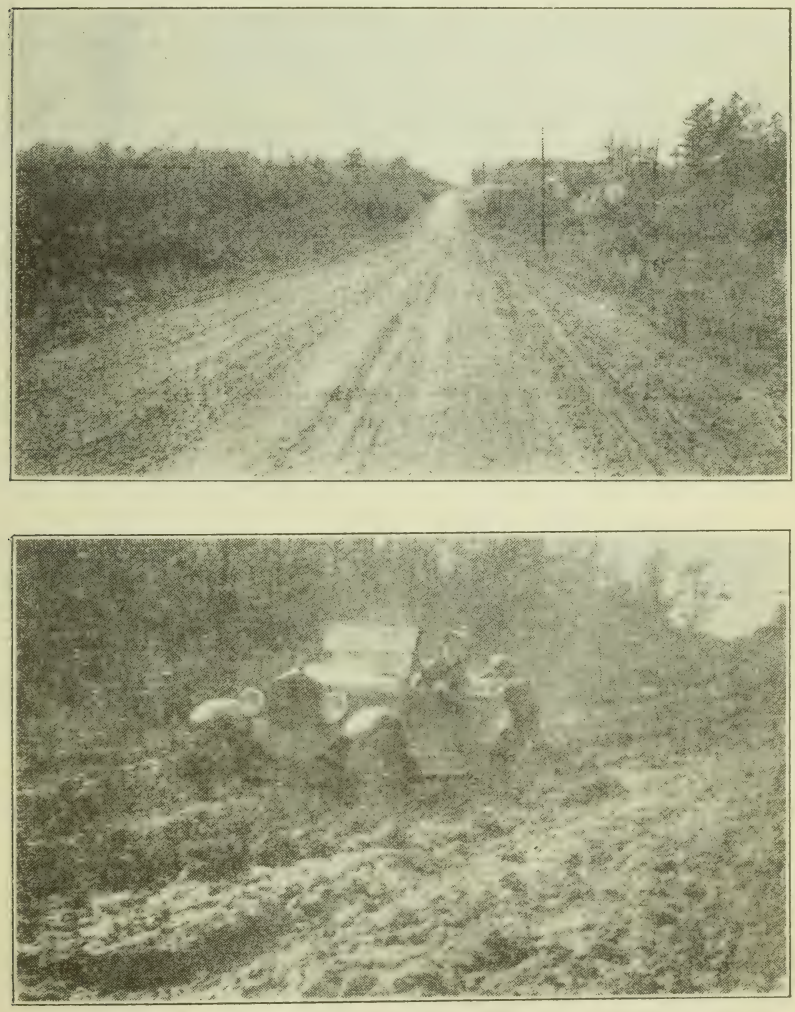


Fig. XII—Top: a properly graded and graveled road. Bottom: a properly graded road, but not graveled. The pictures were taken the same day and both views show hills crossing small bottoms. Gravel made the difference.

It appears that in the county's road program errors of judgment have not been infrequent. Bonds were floated at a time when prices for labor and materials were high and money cheap to be redeemed at a period during a part of which at least, prices are low and money dear. In other words, a dollar will purchase more labor and material now as the bonds are being redeemed than it purchased when the money was spent. One of the cardinal priciples involved in issuance of public improvement bonds is that the improvement should last at least until the last of the bonds shall have been retired. With few exceptions, this principle has been violated in regard to the local road bond issues of the county. The funds have been expended and retirement of the bonds has scarcely begun, still some of these roads become impassable for motor vehicles for weeks at a time and impassable for horse drawn vehicles for shorter periods. It appears that the district was too small and the funds too meagre to purchase the necessary rights of way or to justify the employment of a trained engineer to establish proper grades. As a result, the work was undertaken by local people who, because of lack of training and inexperience, were unable

A COMMON TYPE OF ROAD IN CHOCTAW COUNTY

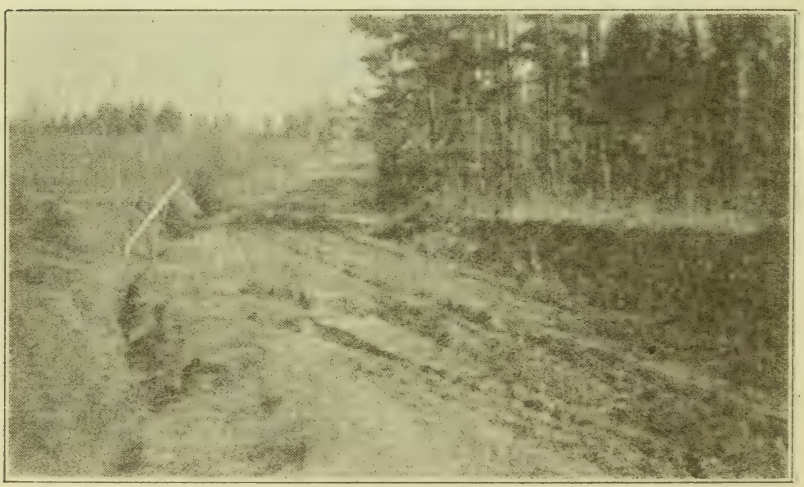


Fig. XIII—This is the usual type of road found in the county. In dry weather it serves its purpose well, but it is too narrow and too crooked to obtain proper grades. Upkeep cost is high and extended wet weather makes it impassable.

to obtain the best results with the means at hand. Attention has been called to these errors, not in a spirit of unfriendly criticism, but that they may be guarded against in the future by these and other local communities.

TABLE 18—SUMMARY OF SCHOOL EXPENSES EXCLUSIVE OF ACKERMAN SEPARATE DISTRICT, ADMINISTERED BY THE SUPERINTENDENT OF SCHOOLS CHOCTAW CO. MISS.

Type of Schools	Salaries and Tuition	Transportation of Pupils	Other Expenses	Totals
Term 1927-1928				
	Dollars	Dollars	Dollars	Dollars
Agricultural High School	7240		1941	9181
Weir Consolidated	7480	2800	1395	11675
All other consolidated	22530	14517		37047
White Grammar	7500			7500
Negro Grammar	5628			5628
Totals	50378	17317	3336	71031
Term 1926-1927				
Agricultural High School	7400		1447	8847
Weir Consolidated	6590	2274	1776	10640
All other consolidated	19168	12014		31182
White Grammar	7203			7203
Negro Grammar	4948			4948
Totals	45309	14288	3223	62820
Term 1925-1926				
Agricultural High School	6698		2693	9391
Weir Consolidated	5760	2920	1664	10344
All other consolidated	16170	10245		26415
White Grammar	7336			7336
Negro Grammar	4815			4815
Totals	40779	13165	4357	58301

Expenses on Schools

Although the expenditures for education rank second to road expenditures in the county, it is probably more important from the standpoint of the well-being of the people. Partly for this reason and partly because statistical data pertaining to schools was easier to assemble, these data were secured in more detail and covered a longer period than data pertaining to other expenditures. Data pertaining to the Ackerman Separate School District are not included since the greater part of this school's support and patronage is from the city of Ackerman. Other than the Ackerman school, the county has an agricultural high school, nineteen consolidated school districts, one of which is in connection with the agricultural high school, sixteen white grammar schools and twenty-seven negro grammar schools.

The present plan is to consolidate the white grammar

schools as fast as circumstances permit. 1*

A summary of school expenses for three school years is shown by Table 18. Salaries have increased at the rate of about $5000 per year for the period covered. Transportation expense has increased at the rate of about $1000 per year for the same period. Other expenses, which apply only to two schools, decreased from 1925-6 to 1926-7 and increased the next year. This was due to the purchase of livestock and equipment for the agricultural high school in 1925. Had strict accounting method been used, this expense would have been distributed over a number of years. Total expense for schools has steadily increased for the period. This increase has taken place both on the basis of school type and school functions within a type. The increase appears to be due to improvement in teaching and school facilities.

With the exception of the county agricultural high school and the Weir consolidated school, the only expenses for schools paid from regular tax money are for teaching and transportation of pupils. The cost of fuel is met by an assessment against the patrons of from 50 cents to one dollar per pupil. This item is not included in tables pertaining to grammar schools and consolidated schools other than that at Weir. Grammar schools, being unconsolidated, have no transportation expenses.

Of the nineteen consolidated schools, five taught through the eighth grade, one through the eleventh, and four through the twelfth. Thirteen had six month terms in 1927-8, four had eight month terms and two had nine month terms. In 1926-7 there were seventeen such schools, twelve of which ran six months, one seven months and four eight months. In 1925-6 there were only fifteen such schools in operation. This type of school is increasing in number and the length of term is also being gradually increased as financial means permit. The increased amount expended for salaries from year to year indicates that a better qualified teaching force is being employed.

In the three school years 1925-6 to 1927-8, sixteen white grammar schools were operated. These were all eighth grade schools and, with the exception of one with an eight months term, operated on a six months term basis.

*1 Since this study was begun, white grammar schools have been reduced, by consolidations, to three.

While the number of these schools remained constant, the pupils attending tended to decrease as consolidated schools were organized.

Twenty-seven negro grammar schools were operated in 1927-8, twenty-six in 1926-7 and twenty-eight in 1925-6. Two of these schools taught through the ninth grade while the remainder taught through the eighth or lower grades. In 1927-8, twenty-four of these schools had terms of five months, two had terms of five and one-half months and one had a six months term.

TABLE 19—COMPARATIVE DATA ON SCHOOLS CHOCTAW COUNTY, MISS.—1924-1928

Item	Wier Consolidated	All other consolidated	W. Gram. school	C. Gram. School
Term 1927-1928				
Total schools ..... number	1	18	16	27
Total Teachers *1 ..... number	9	49	18.5	35
Total Pupils Enrolled ..... number	300	1707	440	1195
S. Average length of term ..... months	8	6.67	6.12	5.1
W. Average pupils per school ..... number	300	94.8	27.5	44.3
W. Average pupils per teacher ..... number	33.3	34.8	23.8	34.1
S. Average salaries per school ..... dollars	7480.00	1251.67	468.75	208.46
W. Ave. teacher's salary per term ..... dollars	831.11	459.80	405.40	160.81
W. Ave. teacher's salary per month ..... dollars	103.89	68.93	65.97	41.03
W. Ave., annual cost of teaching per pupil dollars	24.93	13.20	17.04	4.71
A. Ave. annual trans. cost per pupil ..... dollars	9.33	8.39		
W. Ave. annual other cost per pupil ..... dollars	4.66			
W. Av. annual total cost per pupil ..... dollars	38.92	21.59	17.04	4.71
Term 1926-1927				
Total Schools ..... number	1	16	16	26
Total Teachers *1 ..... number	8	42.5	18.5	31
Total Pupils enrolled ..... number	250	1449	452	1154
S. Average length of term ..... months	8	6.40	6.12	5.00
W. Average pupils per school ..... number	250	90.5	28.2	44.4
W. Average pupils per teacher ..... number	31.2	34.1	24.4	37.2
S. Average salaries per school ..... dollars	6590.60	1198.00	450.16	190.30
W. Ave. teacher's salary per term ..... dollars	823.75	451.01	389.32	159.60
W. Ave teacher's salary per month ..... dollars	102.97	70.47	63.36	37.77
W. Average annual cost of teaching per pupil ..... dollars	26.36	13.23	15.93	4.29
W. Ave. annual trans. cost per pupil ..dollars	9.02	8.29		
W. Ave. annual other cost per pupil ....dollars	7.10			
W. Ave. annual total cost per pupil .....dollars	42.48	21.52	15.93	4.29
Term 1925-1926				
Total Schools ..... number	1	14	16	28
Total Teachers *1 ..... number	8	38.0	18.5	35
Total pupils Enrolled ..... number	230	1246	445	1219
S. Average length of term ..... months	8	6.50	6.12	5.00
W. Average pupils per school ..... number	230	89.0	27.8	43.5
W. Average pupils per teacher ..... number	28.8	32.8	24.1	34.8
S. Average salaries per school ..... dollars	5760.00	1154.97	458.50	171.96
W. Ave. teacher's salary per term ..... dollars	720.00	426.07	396.54	137.56
W. Ave. teacher's salary per month .....dollars	90.00	65.55	64.53	34.15
W. Average annual cost of teaching per pupil ..... dollars	25.04	12.98	16.48	3.95
W. Ave. annual trans. cost per pupil ....dollars	12.70	8.22		
W. Ave. annual other cost per pupil ....dollars	7.23			
W. Ave. annual total cost per pupil .....dollars	44.97	21.20	16.48	3.95

Term 1924-1925

Total Schools	number	1	14	16	29
Total Teachers *1	number	8	35.2	18.5	35
Total Pupils enrolled	number	234	1240	454	1407
S. Average length of term	months	8	6.50	6.12	5.00
W. Average pupils per school	number	234	88.6	28.4	48.5
W. Average pupils per teacher	number	29.2	35.2	24.5	40.2
S. Average salaries per school	dollars	5760.00	1054.62	433.55	163.81
W. Ave. teacher's salary per term	dollars	720.00	419.45	374.96	135.73
W. Ave. teacher's salary per month	dollars	90.00	64.53	61.02	32.43
W. Average annual cost of teaching per pupil	dollars	24.62	11.91	15.28	3.38
W. Ave. annual trans. cost per pupil	dollars	7.83	7.22		
W. Ave. annual other cost per pupil	dollars	7.41			
W. Ave. annual total cost per pupil	dollars	39.86	19.13	15.28	3.38

*1 In cases where Choctaw County pays a fractional part of a teacher's salary, such fractional part of a teacher was counted.

S.—Simple

W.—Weighted.

Tables showing detailed information pertaining to the expenses, lengths of term, number of teachers, number of pupils, and grades taught by schools, are contained in the appendix.

Table 19 shows comparative data on the different types of schools over the four school-year period from 1924-5 to 1927-8. From the column headed "Weir Consolidated" it may be seen that the number of pupils enrolled has gradually increased while the number of teachers has remained constant, resulting in an increase in the average number of

SECOND CONSOLIDATED SCHOOL ESTABLISHED IN THE COUNTY

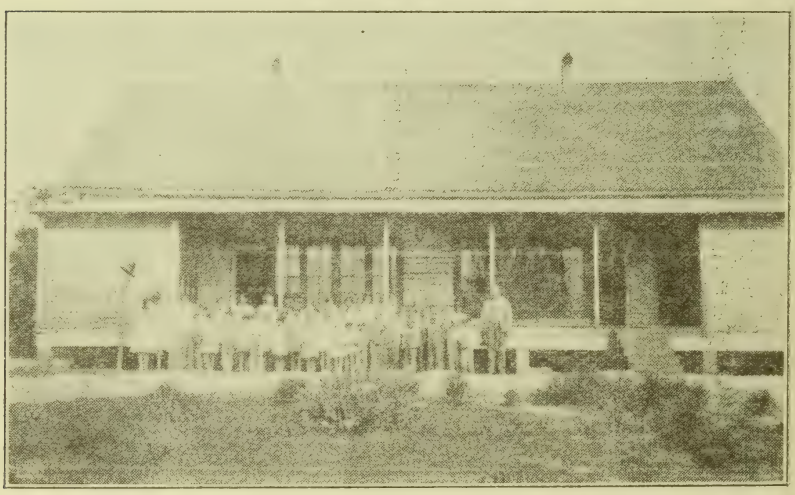


Fig. XIV—This three-teacher school is typical of the older consolidated schools of the county. The grounds are well kept, thus cultivating in the pupils a desire for beautiful surroundings as well as improving their minds.

pupils per teacher. The salary expense of this school has increased, and since the number of teachers and the lengths of term were constant, it is evident that the increase was due to increased salaries per month and per term. This is due to the effort being made to improve the quality of the teaching, not only in this school, but in all schools of the county.

ONE OF THE NEWER CONSOLIDATED SCHOOLS

Fig. XV. This is a nine-teacher school, modern in construction, but lacking in equipment. Schools like this constitute the highest type of public investment. Sufficient equipment should be provided that the maximum returns will be obtained.

The average cost of teaching per pupil increased up to 1926-7, but showed a decrease in 1927-8. Transportation cost per pupil showed a marked increase from 1924-5 to 1925-6, decreasing the following year and remaining practically constant the last year of the study. Other costs per pupil remained fairly constant the first three years, decreasing the fourth. The average annual total cost per pupil at this school increased from 1924-5 to 1925-6 after which it decreased steadily to 1927-8.

The number of consolidated schools is being increased as means permit since this type of school permits pupils to secure a part or all of their high school education while living at home and at the same time permits a more complete utilization of teaching ability by assigning teachers to those

subjects in which they are especially trained.

In consolidated schools other than at Weir, the number of pupils has increased with the increase in number of schools. The number of teachers has also increased together with salaries per school and salaries per teacher. The average annual cost per pupil for this type of school increased only $2.46 over the four year period. In this connection, it may be remarked that as the road construction as now planned progresses, there should be some reduction in the cost of transportation of pupils.

The number of white grammar schools has remained constant over the four year period which, in view of the increase in consolidated schools, indicates that schools are becoming more numerous and that they can be reached with more facility. Average costs per pupil have increased due to increased teaching salaries, the only expense met from tax funds.

A ROSENWALD SCHOOL OF CHOCTAW COUNTY

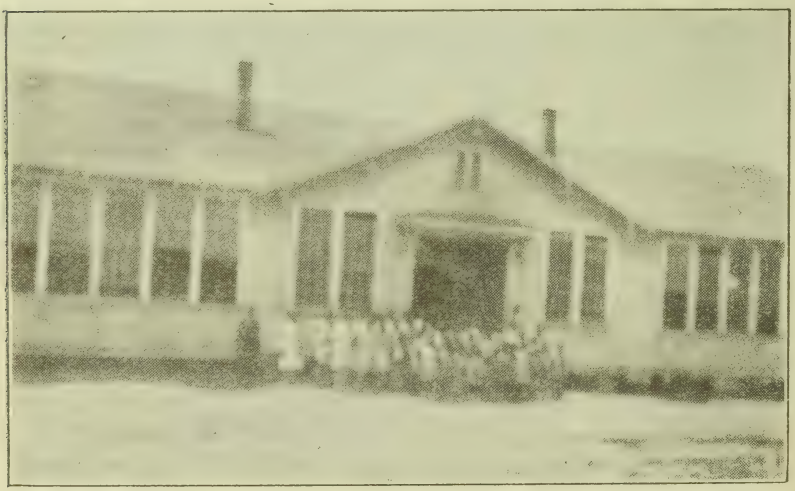


Fig. XVI. This is one of the better schools for negroes found in the county. It has four teachers and some manual training is taught. The picture was taken just before the spring closing. At mid-term there were four times as many pupils in attendance. This school was very poorly equipped.

The number of negro grammar schools is variable due to the migratory nature of the negro population. The cost of teaching in these schools has also increased resulting in

higher average cost per pupil. The average cost of operating these schools is small as compared to operating schools for white pupils. The feasibility of giving negroes the advantage of a common school education has been questioned

A ONE-ROOM, ONE-TEACHER NEGRO SCHOOL

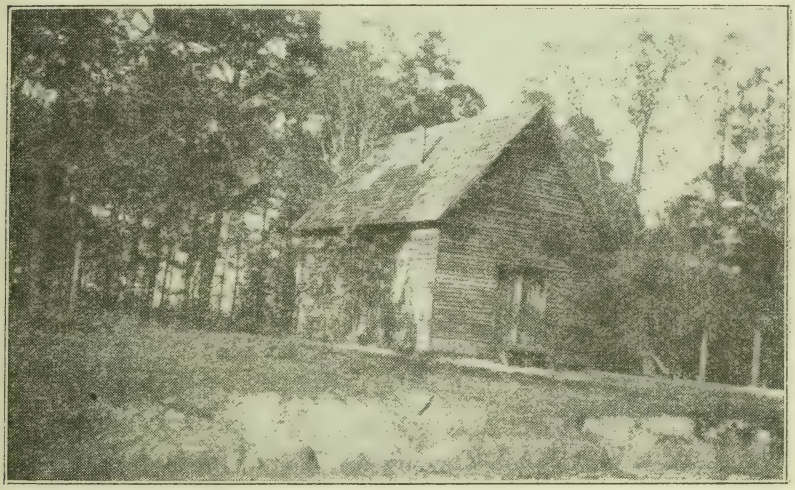


Fig. XVII The equipment of this schoolhouse consisted of a cheap stove and a few home-made benches—and the bell. The pupils were very proud of the bell. This type of school should be the next to go.

by some of the white citizens in the past, and there may still be some who are doubtful of its value. It may be suggested that, since the negro race supplies a large part of the farm labor, if such labor were better educated, its employment might be found more profitable. The desire for a higher standard of living on the part of the negro should result in better and more work at a profit to himself and his employer. With an abundance of untilled land in the county, there is a possibility through education of making land owners and tax payers out of many of the negroes of the county who are now mere laborers who contribute nothing directly to the county's support. The advisability of improving the educational facilities for negroes is worthy of serious thought.

Education as Related to Urban and Negro Population

Census data were consulted to determine, if possible, the influence of urban population and negro population on

educational standards. For this purpose, statistics for Choctaw, Lee and Lauderdale counties and the state of Mississippi were compared. It was thought that with a higher percentage of the population living in cities, towns and villages, there would tend to be more taxable wealth and perhaps the length of school terms would be longer generally. With a higher percentage of negro population, a higher percentage of illiteracy might also be expected. Tabulated data are shown in Tables 20, 21 and 22.

TABLE 20—PERCENT OF CHILDREN BETWEEN THE AGES 7 TO 20 YEARS OF AGE ATTENDING SCHOOL BY AGE GROUPS—CHOCTAW, LEE AND LAUDERDALE COUNTIES AND STATE OF MISSISSIPPI, U. S. CENSUS DATA—1920

Political Subdivision	Negroes in tot. pop.	Children Attending School at Different Ages				
		7 to 13 years	14 and 15 years	16 and 17 years	18 to 20 years	Total 7 to 20 years
	Percent	Percent	Percent	Percent	Percent	Percent
Choctaw County	28.4	81.9	78.2	61.3	32.1	70.5
Lee County	32.9	85.5	82.4	61.6	25.8	71.5
Lauderdale County	40.8	89.0	80.3	55.6	20.2	70.5
State of Miss.	52.2	80.1	75.2	51.7	18.6	64.7

TABLE 21—PERCENTAGE OF ILLITERACY AMONG WHITES AND NEGROES, CHOCTAW LEE, AND LAUDERDALE COUNTIES AND STATE OF MISSISSIPPI— U. S. CENSUS DATA—1920 AND 1910

Political Subdivision	1920			1910		
	Total 10 years and over	Native White	Negro	Total 10 years and over	Native White	Negro
	percent illiterate	percent illiterate	percent illiterate	percent illiterate	percent illiterate	percent illiterate
Choctaw County	10.7	4.6	27.1	13.3	6.2	31.7
Lee County	12.0	4.5	27.1	15.9	7.1	31.0
Lauderdale County	12.5	2.4	27.1	17.9	2.5	36.1
State of Miss.	17.2	3.6	29.3	22.4	5.2	35.6

The percentage of city, town and village population in Choctaw, Lee and Lauderdale counties, census of 1920 was respectively 14.8, 26.0 and 51.0. From 1910 to 1920 such population had increased 5.7 percent in Choctaw, 17.6 per cent in Lee, and 2.8 per cent in Lauderdale county. In 1920, the percentage of negroes in the population was: Choctaw County, 28.4; Lee County, 32.9; Lauderdale County, 40.8; and the state Mississippi, 52.2.

It is evident that in counties where the rural population is proportionately large, children are older when they start to school than are beginners in counties with larger urban populations. This would be especially true in counties having poor to average roads. Nor is it likely that rural children progress as rapidly while in school. Table 20 shows the percentage of children attending school at dif-

TABLE 22—POPULATION OF CITIES, TOWNS AND VILLAGES, CHOCTAW, LEE AND LAUDERDALE COUNTIES—U. S. CENSUS DATA

Political Subdivision	Year		
	1920	1910	1900
Choctaw County—Total Population	12491	14357	13036
Town of Ackerman	1204	1398	706
Town of Weir	377	220	91
Village of French Camp	123	220	259
Village of Chester	76	62	132
Village of Reform	69	114	.....
Total—City, Town and Village	1849	2014	1188
Percent of Total County Population	14.8	14.0	9.1
Lee County—Total Population	29618	28894	21956
City of Tupelo	5055	3881	2118
Town of Verona	500	538	456
Town of Shannon	498	564	434
Town of Saltillo	440	306	209
Town of Guntown	365	330	325
Town of Nettleton (in Lee Co.)	303	352	264
Village of Plantersville	275	165	187
Village of Belden	268	220	.....
Total—City, Town and Village	7704	6376	3993
Percent of Total County Population	26.0	22.1	18.2
Lauderdale County—Total Population	45897	46919	38150
City of Meridian	23399	23285	14050
Total—City, Town and Village	23399	23285	14050
Percent of Total County Population	51.0	49.6	36.8

ferent ages. It may be seen that in the age group, 7 to 13 years, the percentage attending school increases as the percentage of urban population increases in the three counties while in the age group, 18 to 20 years, the condition is reversed, indicating that rural children start to school later in life, continue in school longer, or both. The percentage of all children, 7 to 20 years old, in school is approximately equal for the three counties, but is lower for the state, probably because of the large percentage of negroes in the population.

Table 21 shows the percentage of illiteracy in the three counties and the state divided as to whites and negroes at the two census periods, 1920 and 1910.

Comparing the percentages of illiteracy in the total population over ten years of age, 1920, it is evident that a higher percentage of negroes in the population tends to outweigh the educational advantages due to a large urban population. The percentage of illiteracy increases directly with the percentage of negro population. Among whites, percentage of illiteracy decreases in the three counties as the percentage of urban dwellers increases, while for negroes the percentage remains constant. The fact that the percentage of illiteracy is greater among negroes for the

state than in any of the three counties is perhaps due to better school facilities for negroes in the hill counties than for the Delta counties which have very large negro populations.

TABLE 23—FRESHMEN ENTERING MISSISSIPPI COLLEGES AND UNIVERSITIES FROM CHOCTAW, LEE AND LAUDERDALE COUNTIES IN THE FALL OF 1920

Institution entered:	Entered from		
	Choctaw County	Lee County	Lauderdale County
	Number	Number	Number
University of Mississippi	6	15	15
Mississippi A. & M. College	6	7	[illegible]
Mississippi State College for Women	11	26	34
Millsaps College	0	1	2
Mississippi College	2	4	2
Grenada College	0	2	1
Alcorn A. & M. College	0	1	1
Total	25	56	[illegible]
Population for each freshman entering	500	529	729
White population for each white freshman entering	357	361	438

Note: The Delta Teachers' College was not established until 1925.
State Woman's College and Blue Mountain College did not answer the inquiry.

Reductions in the percentage of illiteracy for the total over ten years of age between 1910 and 1920 were 19.5 per cent for Choctaw, 24.5 per cent for Lee, 30.2 per cent for Lauderdale, and 23.2 per cent for the state. Here again there seems to be an advantage for urban population when only the counties are compared. Reduction in the percentage of illiteracy among whites for the same period and same political divisions was 25.8, 36.6, 4.1 and 30.8 per cent respectively. Comparable percentages for negroes are: 12.6, 24.9, and 17.7. It appears that illiteracy among whites has reached a point in Lauderdale County where further reduction is difficult, therefore the stamping out of illiteracy among negroes was more pronounced than that among whites. It is worthy of note that the percentage of reduction was lower in Choctaw County than in the state both for whites and negroes.

Although children of a rural county with little taxable wealth seem to be at a disadvantage in acquiring an education, such a county may contribute a comparatively large number of citizens to posts of leadership. Information was secured from seven of the eight educational institutions of college grade in the state as to the number of freshmen entering from the three counties compared in the fall of 1920. The results are tabulated in Table 23.

Choctaw County had a larger number of young people entering college per unit of total population and per unit of white population than either Lee or Lauderdale counties. In this respect, Lee showed a higher percentage than Lauderdale. The percentage of total population which enters college is doubtless influenced largely by the percentage of negroes in the population, but the percentage of whites entering college must be accounted for in some other way. Two causes may be suggested. In populations largely urban, pupils finish high school younger in age when the desire to, and opportunity for, work is valued more than the possible advantages of an education. On the other hand, children of rural communities are older when they finish high school. Their more mature judgment, coupled with the absence of opportunities to secure employment in the community, leads them to secure a higher education. It is not improbable that the low standard of living found in many rural communities also prompts the young people of such communities to make an attempt to improve their condition by going to college.

Remedial Suggestions

In suggesting remedies for the rural tax situation, it may be stated in the beginning that there is little likelihood of any material decrease in total public expenditures. Roads and schools, the two largest items in the county budget are looked upon as necessities and rightly so if progress is to be made. More and more, the public is undertaking to supply collectively conveniences and services which each citizen could not supply for himself. These conveniences and services should be considered as a public investment, and while every citizen may not profit directly and individually, the collective public certainly profits from investments in schools, roads, county agricultural agent work, public health service and similar undertakings when the funds are honestly and wisely administrated. The suggestions which follow, therefore, will not aim so much at reducing the amount of public expenditures, as at suggesting a more even distribution of the costs of government among the citizens and a more economical administration of the public funds.

Individual Effort

In easing the burden of taxation, there are few things

which the taxpayer can do individually, but these few are of the utmost importance. In a democracy, any laxity in government must eventually rest upon the shoulders of the individuals which compose it. It therefore behooves every citizen and taxpayer to familiarize himself with the workings of government both local and state. Conditions must first be understood before they can be improved. In studying the public issues, he should take the viewpoint of the public, for not infrequently a public good is opposed to interests of particular individuals. Many public expenditures are in the nature of investments. To many farmer individuals, the investment cycle covers only one year, but from the standpoint of the public, an investment cycle may cover a generation or a longer period. Community, county and state progress require long time programs, for the public mind changes slowly.

The individual should not permit himself to become a slave to custom; nor do laws have any sanctity except as they serve the common good. Custom and sentiment may be great stumbling blocks in the way of progress in any social group. A custom may have had logical grounds for its basis at the time of its establishment, but time and the changes which it brings may entirely alter the situation. "New occasons teach new duties; time makes ancient good uncouth". Sentiment may be beautiful in a way, but it pays no cash dividends. Its gratification together with the gratification of vanity may well be dropped from the public budget. Laws which serve no good purpose should be repealed. Laws should be for the benefit of the living rather than to preserve the memory of the dead. A marble shaft constitutes a more fit memorial than does a law on the statute books.

In addition to studying the workings of government and the issues to be decided in order to act with more wisdom in conjunction with his fellows, the individual may well study his own business that he may eliminate as far as possible those parts of it which are non-productive. It has been shown that rural real estate is the largest contributer to the treasury of Choctaw County, yet only a small percentage of land of the county is producing revenue. In 1925, according to the agricultural census, 24.5 percent of the land in farms was in crops; 31.5 percent was in pasture

and 34.1 percent in woodland. Crops constitute the principal source of farm income, but all land is taxed. Does the pasture and woodland yield returns sufficient to pay the taxes? The farmer may well ask himself. The acreage devoted to pasture provided 4.3 acres per head for each horse, mule, cow, calf and hog listed in the census. If hogs, which were actually provided with very little pasture, are excluded, there was an average of 5.4 acres of pasture per animal remaining in the count. The returns from land so used are small, indeed. Returns from woodland are difficult to estimate, but a survey of the county indicates that such income as is being derived from woodland, comes from cutting trees which have survived the fires of the past ten or twenty years without man's aid. On the contrary, the deliberate setting of fires is not an uncommon practice.

It is not intended to suggest that a larger percent of the farm land be cleared and planted to crops. Perhaps, only the best of it is fit and adaptable for row crops. The next best may be used for hay crops, and land still poorer in quality may still be made into good pasture with reasonably good management. The poorest land in the county will produce a crop of merchantable timber in twenty years if fire protection is provided. Some revenue should be obtained from all land in farms in the county. The poorest of it should return enough to pay taxes and possibly a small rate of interest if given reasonable care.

Changes in the functions of government are brought about by the collective actions of citizen groups. Only by collective action, therefore, can relief from the present tax situation be obtained. In addition to the preceding suggestions relative to the individual's attitude toward public affairs, attention may be called to the fact that we are governed by, and all public business is transacted in accordance with, laws. These laws range from the Constitution of the United States and the federal statutes downward to the ordinances of villages and similar local political subdivisions. In all of these laws, none can conflict with the law of a larger subdivision of which the smaller subdivision is a part. It follows that the smaller the subdivision, the more laws it may have for it is not only subject to the laws of the political organizations of which it is a part, but it may have a few of its own so long as they do not conflict with higher authority.

Group Action

In the suggestions which follow, numerous laws are involved, to change which necessitates collective action. In some cases, perhaps the action of a small group such as a district may obtain the desired results. In other cases, the county, the state or the national government may constitute the unit. No attempt will be made here to designate which group should finally present the matter, since any group, regardless of the numbers composing it, is ordinarily made up of smaller groups which in turn are composed of individuals. Great movements have developed from the actions of what was a small group in the beginning.

More Equality of Assessment Desirable

With the great dependence which is placed on the general property tax for revenue, it is highly desirable that this tax be made as equitable as is humanly possible. This study has shown that there is a wide range in percentage of estimated true value at which property is listed for taxation. Other studies have shown that certain classes of property are undervalued as compared to other classes. It is known that considerable taxable property escapes the payment of taxes entirely. Although, according to law, all property should be listed for taxation at its true value, records indicate that farm property in Choctaw County was listed at less than 50 percent of its true value. The custom of listing property at less than true value is well established and it is unlikely that true values can possibly be obtained so long as each owner lists the value of his individual property.

The responsibility for securing a complete list of the property in a county together with its value is on the assessor. Property overlooked by the assessor rarely finds its way to the tax rolls although the Board of Supervisors are empowered to find and list it.

Undervaluations of individual properties too often go uncorrected by the Board of Supervisors, not so much because of a lack of interest or willingness, but because the twenty days allowed by law is insufficient time in which to give careful consideration to the tax roll. The suggestions in regard to the assessor which follow, if carried out, should partially remove the need for adjustments, but it is prob-

able that the granting of more time to the Board for making its adjustments would be an act of wisdom. The Board of Supervisors is the only body which has power to make adjustments in the individual assessments of rural properties. To raise the assessment by a certain percentage on a certain class of property, or on all property, of a county either on motion of the Board or at the command of the State Tax Commission is quite satisfactory as a basis for equalizing assessments as between counties, but it does not alter the relationhip between individual assessments.

The most important officer having to do with taxes is the assessor and improvement in the functioning of the assessor's office should aid materially in obtaining a more uniform assessment. Suggestions in this respect are:

First, to pay the assessor a salary sufficient to attract men of high type and which would permit some dignity of the office; second, provide him with an office and equipment worthy of the name; third, double or perhaps triple the present term of office to remove the tendency to trade favors for votes. In lengthening the term of office, certain irregularities such as failure to place property on the rolls or marked differences in value of similar properties could be made cause for removal; and fourth, empower the assessor to make back assessments where and when they are discovered, to examine books and records when desirable to determine values of taxable property, and to enter upon any premises for the purpose of valuing and assessing property.

Another possibility is the creating in each county of an assessment board or committee, composed of three elected members, which would be empowered to assess either all property or which might confine its activities only to real estate, such board to assess the property at its true value with or without the opinion of the owner. With this plan, the taxpayer should have the privilege of objecting to his assessment as he now has.

Taxes Other Than the General Property Tax

The public is slow to relinquish the general property tax because of long continued usage although its administration is becoming ever more difficult and changed conditions since this form of tax was instituted have led to many inequalities and abuses.

Numerous other forms of taxation have been proposed. Some have been adopted either as permanent measures or during periods of emergency. In advocating tax measures, it is not infrequent that an attempt is made to relieve one class of taxpayers at the expense of another. Such adjustments do not solve the problem. More may be gained by working toward a more equitable and just distribution of the tax burden.

To this end, a number of forms of taxes are desirable since with our complicated form of society no one form of tax will be equitable and just to all of its members.

In adopting different forms of taxes, good judgment and great care should be exercised. The taxing power is far reaching in its effect. It may be used either for revenue or regulatory purposes. Since undesirable institutions may be held in check or destroyed by the taxing power, it follows that an unusually burdensome tax designed for revenue may seriously impair or even destroy the institutions to which it applies.

The cost of collecting and remitting the tax should be considered—not only from the standpoint of dollars, but from the standpoint of time and worry.

The incidence of a tax or that phase which has to do with shifting it from one to another should not be overlooked. Taxes on rented properties may be reflected wholly or in part in the rent. Every enterprising merchant endeavors to recover the amount of his taxes in addition to his ordinary profit out of the price of the goods he sells. Every one knows that a direct sales tax is ordinarily paid by the purchaser of the goods.

A particular from of tax is not equally applicable in all political units. Indeed, certain forms such as the tariff are reserved for the federal government. Other forms, as the income tax, might function quite well when levied by the state, but are wholly unadapted as county measures. For counties and their political subdivisions, it appears that the general property tax will long remain the princpal source of revenue. Although they may and do levy a few other forms of taxes, the revenue so obtaned is not great.

Generally speaking, the general property tax is best adapted for the use of counties and smaller political units. The state constitutes a fit unit for levying privilege taxes,

certain forms of sales taxes, income taxes and taxes on natural resources when severed from the soil. The federal government, only, is empowered to collect impost revenue. It is also in position to levy and collect certain sales taxes, income taxes, inheritance taxes and privilege taxes.

Any tax levied should be adapted to the political unit making the levy. It should be just and fair to the payers and others whose welfare is affected by it: it should be workable and it should not be so burdensome or disagreeable as to defeat its own ends.

Because of the possibility of shifting taxes and indirect taxes, the spending of all tax money where collected is not always advisable. Such a practice tends to enrich certain communities as others become ever poorer. This tendency has led to the appropriating of federally collected funds to the states and of state collected funds to the counties. Where such funds are used for purposes beneficial to all citizens such as schools and roads, the movement is desirable, but it should not be carried so far as to deprive the people of a community of their self respect or the management, within reason, of their own affairs.

Reduction of Expenses

It has been stated that there is little prospect of materially reducing public expenditures. This statement was based on the retention of present political organizations. By radical reorganization, there are possibilities for great reduction in governmental costs. Some of the following suggestions are admittedly radical, but they are worthy of consideration. Greater changes have occurred. Time coupled with dire necessity can alter even governmental units.

Consolidations

In the realm of private business, one of the most outstanding movements toward greater efficiency and more economical operation is that of consolidations and mergers. It is not unreasonable to suppose that, if this movement reduces expenses and results in more profit for the business or cheaper goods for the consumer, the same principle would apply in the case of public business. Great improvements of transportation and communication facilities in recent years have rendered many public offices and institu-

tions obsolete and unnecessary at the present time from a practical business standpoint.

Consolidation of schools for white children is practically complete in some counties and is well under way even in the more backward counties of Mississippi. Although the actual total cost of operating schools is slightly more than under the old system, the returns in better educational facilities far outweigh the added cost. Consolidation of schools is a public investment which pays handsome dividends.

As a next step, a consolidation of road districts might well follow, but the movement need not stop here. A few counties of the state still maintain two court districts which, not only add to the governmental costs, but serve to keep the county divided on questions involving the common interests of all the people of the county. It is not improbable that, could the people of the state but lay aside sentiment and pride, great savings could be realized by a consolidation of counties. Such a suggestion, at first thought, seems radical indeed, but when it is remembered that when our present county boundaries were formed it required a full day and sometimes more to make a trip from a point on the boundary to the center of the average size county and back, while at present such a trip would ordinarily be made in two hours or less, the idea seems worth considering. When most of our counties were formed, the country was new; there were no cities and few railroads. Taxable wealth was fairly equally divided among them. Today this is not the case. Because of natural and economic conditions, some have prospered more than others. In 1927 the ratio of the assessment of the richest county of the state to that of the poorest was as 16 to 1. The ratio of the average assessment of all counties to that of the highest was as 1 to 5 while the ratio of the average to the lowest was over 3 to 1.

By completely consolidating many of our counties in groups of from two to four depending on geographic conditions and transportation facilities, the time and expense of making a trip to the courthouse would be no greater for the average rural citizen than it was ten years ago. As the road building program as now projected approaches completion, visiting the courthouse would be a still smaller un-

dertaking. By designating banks as the official collectors of taxes, as will be suggested later, the necessary visits to the courthouse could be greatly reduced. The number of political jobs would be reduced as well as the upkeep on public buildings. It would result in a more equal distribution of wealth among counties. Educational facilities would be more equal. Better trained personnel could be secured for the direction of public undertakings while much of the county business which is now conducted by officials who are untrained, though perhaps honest and willing, could be carried out by deputies or assistants. Petty rivalries would be to some extent eliminated. To gratify the pride and foster the community spirit of those towns and villages which might lose a county seat by the consolidation, a suitable memorial to the old regime could be erected in the form of a community building, a park or aviation field which would be an asset to the community rather than a liability.

Opposition to removing a county seat or efforts to secure it are, as a rule, fostered by merchants and other business men who expect to profit from the trade of rural people who come to the town to transact business at the courthouse, and from the distribution of salaries paid from the public treasury. The appeal, however, is made to the pride and prejudices of the people. To retain a system and conditions which are obsolete is expensive whether done privately or publicly. If sufficient satisfaction is secured by the retention of the present outgrown condition to justify the cost, well and good, but farmers especially should fully satisfy themselves as to why so many court districts, public buildings and public officials are necessary or desirable.

Pertaining to Roads

Although more money was spent on roads than on any other one item in Choctaw County and over a half million dollars of road bonds were outstanding, with the exception of perhaps 50 miles of the 600 in the county, the roads were only fair or poor.

It appears that, generally local road construction was directed by local contractors who had no training in engineering; that original rights of way were followed; that the relation of grade and soil type to washing was given no consideration; and that proper drainage was in numerous

cases neglected.

Under the present system, each beat maintains its roads with separate equipment. Road dragging and grading is let by contract to individuals who have no other occupation. The Board of Supervisors, one member for each beat, is responsible for the condition of the roads each in his particular beat. Supervisors are paid for inspection services. The total cost to the county of such services amounted to $3343.00 in 1928. The following suggestions are offered as possibilities for remedying this situation:

FIRST: The employment of a trained highway engineer whose duties would be to lay out all new highways; to suggest changes in present rights of way to obtain the best relationships between distances and grades; to plan, recommend and superintend all construction of roads and bridges undertaken by the county; and to perform all road inspection services.

SECOND: Pool all road working equipment of the county, placing it in charge of the proposed engineer and holding him accountable for its proper use.

THIRD: Employ local farmers equipped with light

COUNTY ROAD EQUIPMENT

Fig. XVIII Such equipment can be seen standing idle somewhere in the county on almost any day. The roads in the beat where this equipment belonged were in good shape as shown in the foreground, but roads in other beats were extremely rough. Much might be saved by pooling all equipment in the county and making one man responsible for its proper use.

drags to drag roads adjacent to, or near their property instead of contracting with a few individuals to maintain the roads of an entire beat.

The adoption of such a change should insure proper grade and width of roads so that maintenance costs could be kept to the minimum consistent with terrain, soil type and amount of traffic. New construction costs should be lowered by having plans drawn and construction superintended by a trained engineer. Inspection services should be more uniform and the inspector could be held strictly accountable. By pooling all equipment, a more economic use could be made of it by moving the larger units about the entire county wherever needed. The amount of idle equipment could be greatly reduced which would mean a reduction in the amount of equipment needed. With one man in charge instead of five, accounts could be checked more closely and doubtless savings could be brought about in repair bills and expenditures for tractor fuel, oil and grease. By employing local farmers to drag the roads adjacent to or near their property on, perhaps, a per hour basis, the dragging would be more timely since the farmer could do this immediately after rains while it was still too wet for field work. A large number working a few hours each would insure the dragging of all dirt roads before they became too dry for effective dragging. It would, furthermore, distribute this expenditure of public funds among a greater number and tend to return such funds to those from whom it was collected in the form of taxes.

In Regard to Schools

On the whole, the schools of Choctaw County seemed to be as efficiently managed as the existing laws, the finances and the social standards of the citizens would permit. When this study was begun, sixteen one-teacher schools for whites remained in the county. At the present time (May, 1930) this number has been reduced to three. There is still much room for improvement of the school system in the county, however. Such improvement will depend largely on a revision of county odinances and state laws and the passage of federal statutes. These, in turn, depend upon a more enlightened attitude of the citizens of not only the county, but of the state and nation.

With our present transportation and communication

facilities, equality of educational opportunities for all children should be the aim. Work to this end may well start with the county, placing all white children on an equal basis and all negro children on an equal basis by reducing the numerous separate school funds to two, one for whites and one for negroes, and allottong these funds to the several schools in amounts based on the number of pupils after the tangible school properties shall have been equalized. Such an arrangement should improve the citizenship in the poorer districts by providing them with better teachers and equipment and would counteract the tendency for some communities to become progressively poorer while others become richer.

Better educational facilities for negroes should be a paying investment. Such facilities should result in transforming many negroes from non-property owners to property owners, thus relieving white owners of part of the tax burden, since it is logical to suppose that a property-owning negro would produce more taxable wealth than one who owned nothing.

Such a program of betterment from the standpoint of the county would not be complete unless improvement in home living standards is kept abreast of improvement in schools. Unless ideals acquired in the school can be realized in the home community, young people will migrate to those communities where conditions are more to their liking. In this regard every citizen of a community shares in the responsibility.

The movement as outlined is especially desirable on a county basis, but it should not stop with the county. Once attained in a majority of counties, equalization among counties may well be chosen as the next goal. The child of the remotest backwoods district today may be a citizen of a prosperous city in a few years. It is reasonable that the city should aid in giving the child equal educational opportunities with its own.

From a natonal standpoint, two important measures have been suggested, the enactment into law of which would materially aid the poorer communities in their efforts to give their children an education. The more important of these, known variously as the Sterling-Reed bill and Curtis-Reed bill provides for a Department of Education

with a secretary, equal in rank to other department heads in the President's cabinet. It would seem that a department to study and improve our educational system on a national scale, making its findings available to every school in the land, should be at least as desirable as a War Department or Department of the Interior without in the least minimizing the importance and desirability of the latter. The creaton of a Federal Department of Education would be of greatest value to the poorer states of the Union.

The second of the proposed federal measures, known as House Bill 2507, provides for federal appropriations to the states of funds collected as income taxes. The passage of this measure would not only return a part of the funds, collected in a community as income taxes, to the community for educational purposes, but it would tend to equalize educational opportunities between the richer and poorer communities.

County Government

In discussing county government, it is assumed and believed that the officials were honest and their intentions of the best. This report is in no sense intended as a treatise on government, although the members of county boards of supervisors would no doubt find the study of such a work to be of no small value as an aid in rendering the best ser-

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A COMPARISON OF THE TOTAL REVENUE AND NON-REVENUE RECEIPTS WITH THE TOTAL GOVERNMENTAL AND NON-GOVERNMENTAL COSTS FOR YEAR ENDING SEPT. 30, 1928. BASED ON UNIFORM ANNUAL REPORT.

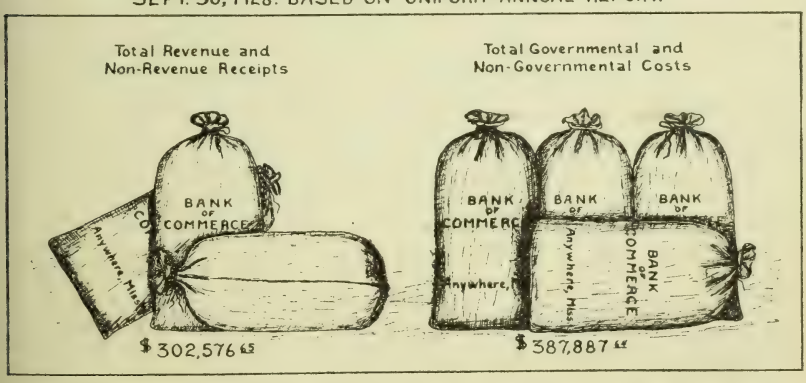

Fig. XIX_ Ordinarily, the only justification for costs running materially more than receipts is in the construction of permanent improvements or in covering losses due to general disasters such as storms, floods and fires. Choctaw Co. is engaged in a road building program.

vice to the county. Most of the suggestions under this heading will pertain strictly to county government. It may be remarked again that govenments are not divine and custom is no excuse for a governmental institution which, because of changed conditions, has outgrown its usefulness.

One of the greatest opportunities for counties to effect a saving in their operating expenses is to dispense entirely with the fee system, the most important example of which is found in the sheriff's office. This method of compensating officers has been entirely outlawed in many states and when it is finally abolished in Mississippi, an important step in county government will have been made.

In 1928, fifteen sheriffs of Mississippi reported net incomes of over $7500, or more than the salary of the Governor of the State. The full net income for the sheriff of Choctaw County for the year 1928 was not reported, but for 1929, the office reported to the Secretary of State $8960 total fees collected and a net income equivalent to salary of $6760. Other sheriffs in the state reported net incomes of over $20,000, while a few were under $1000. This state of affairs is directly attributable to the fee system and the designating of the sheriff as the official collector of taxes. The amount collected as fees by other county officers sinks into insignificance beside the "sheriff business".

It is suggested that the sheriff be placed on a definite salary basis and that the county assume the expenses of the office. The sheriff may still be designated as tax collector or the office of tax collector might be created. In either case, all banks should be designated as receivers of taxes for which they would receipt. With such a system, tax statements could be mailed to the taxpayer by the official tax officer and the taxpayer could pay at the nearest bank, saving himself time and inconvenience and avoiding the rush to pay taxes in the collector's office as the date of delinquency approaches.

Some additional reduction in governmental costs, though small, might be brought about by eliminating some of the petty offices in the county. Choctaw County has at present ten Justices of the Peace and five bailiffs, each drawing a small salary and being empowered to collect fees. With improved transportation facilities, five such

officials could serve the county quite well. A reduction in the number of these offices should insure a more uniform and enlightened administration of justice besides saving a small amount paid in salaries and costs of election.

It is suggested that modern bookkeeping and accounting methods be installed in all counties, and that archaic methods in reporting minutes of board meetings be changed to modern and concise form so that a citizen of average intelligence can determine from an inspection of the county records, not only the financial status of the county and its subdivisions, but also the transactions of the Board of Supervisors as they take place. To this end may be created the office of County Auditor who would relieve the Chancery Clerk of the duty of aduiting the county financial records and in addition would assist the Board of Supervisors in formulating the budget and would exercise control over the county's fiscal system. The requisite training for such an officer should be specified by law and his tenure of office should not be interrupted so long as he performed his duties in a creditable manner.

Finally, it is suggested that county boards conduct the county's business by more businesslike methods thereby saving the time of the board members and the citizens who have business with the board. To expend three or four days in transacting an amount of business which could be easily consummated in one day subjects a county board to the criticism that they look upon the office as a means of making a living rather than as an opportunity to render a public service. The time necessary for board meetings may be greatly reduced by having all business to be considered by the board entered on a book by the clerk at least twenty minutes before the hour set for the board meeting. Any business not so entered should receive no consideration at the current meeting. With such a system, the items of business could be called up in the order of their entry, discussed, and disposition made. At the present time, it is not uncommon for the first day on which a Board of Supervisors is supposed to meet, to be consumed while each member discusses business matters privately with his constituents. Two or three trips to the county seat are often necessary in order to transact a small amount of business with the board. The adoption of the above plan would serve to eliminate this evil.

APPENDIX

TABLE A—STATISTICAL CHANGES ON FARMS OF CHOCTAW COUNTY FROM THE U. S. CENSUS—1880-1925

Population

Year	1925	1920	1910	1900	1890	1880
Total	12000 *1	12491	14357	15026	10847	9056
Native white		8936	10177	9451	8208	6537
Foreign born white		3	11	22	1	1
Negroes		3551	4169	3585	2638	2498
Total farm population	9424	10942	13589	12554	10582	

*1 Estimated from Agricultural Census.

Farms

Year	1925	1920	1910	1900	1890	1880
Number of farms						
Total	1957	2188	2583	2189	1544	1358
White	1535	1673	1916	1684		
Colored	422	515	667	505		
Farms owned free	919	1089	1002	1948	1042	
Encumbered	237	393	548	234	42	
Unknown		76	14	14		

Land area—264960 acres—414 square miles

Year	1925	1920	1910	1900	1890	1880
In farms	203510	228010	237768	217591	199527	169918
Crop land	49866	75416	98422	70290	59996—	38110
Pasture	64205)					3178
Woodland	69491)	—124750	116240)	—147301	139531—	114689
Other	19947	27844	32106)			13941

Year	1925	1920	1910	1900	1890	1880
Farm by sizes						
Under 3 acres	0	2	0	4	0	6
3 to 9 acres	54	47	48	42	9	18
10 to 19 acres	259	235	361	305	57	192
20 to 49 acres	337	525	683	529	270	221
50 to 99 acres	502	535	633	500	350	281
100 to 174 acres	497	510	530	484	726	596
175 to 259 acres	176	188	186	169		
260 to 499 acres	118	120	121	124		
500 to 999 acres	12	22	20	24	28	43
1000 and over	2	4	1	2	4	7
Average size	104.0	104.2	92.1	98.4	138.6	125.9

Year	1925	1920	1910	1900	1890	1880
Farms operated by owners						
Total	1256	1442	1563	1296	1083	924
White	1082	1230	1323	1122		
Colored	174	212	240	174		
Farms operated by tenants and managers						
Total	701	746	1020	893	461	434
White	453	445	593	562		
Colored	248	301	427	331		

Value of Farm Property

Year	1925	1920	1910	1900	1890	1880
All	$2774563	$4709632	$3584040	$1515062	$1858970	$1067282
Land in farms	1428413	2140103	1914045	695070	949120	781559
Farm buildings	656294	1335978	824974	326896		
Implements	165526	268438	194224	83410	60560	37898
Livestock	524350	965113	650709	408692	849290	247775

Year	1925	1920	1910	1900	1890	1880
Average Property values						
Property per farm	$1418	$2115	$1388	$	$	
Land and buildings	1065	1589	1060	463	615	
Land alone per acre	7.02	9.39	8.05			

Numbers and Production of Livestock

Year	1925	1920	1910	1900	1890	1880
Horses	1197	1917	2374	2228	1771	1058
Mules	2792	2579	2203	1945	1222	1135
Cattle	7885	9819	7732	10673	10562	7802
Swine	2966	8025	6731	15049	14245	11969
Chickens	55220	61476	49187	42424	80072	37569
Average milk per cow—gal.	295	212	323	353	202	.....
Eggs produced dozens	181839	254768	258355	189360	158542	86369

Farms on gravel	16
Having tractors	8
Radios	6

Production of Crops

Year	1924	1919	1909	1899	1889	1879
Corn						
Acres	23050	28724	26045	27132	20412	18139
Bushels	274865	340029	271454	445900	286319	243287
Oats						
Acres	1032	1883	2500	2927	4200	3931
Bushels	11329	23405	25515	22250	37411	38709
Wheat						
Acres	145	276	14	251	38	2215
Bushels	1720	1472	92	1410	162	9413
Peas						
Acres	.....	592	570	330	.....	.....
Bushels	.....	1720	2164	3355	2331	9855
Peanuts						
Acres	158	171	188	90	23	.....
Bushels	2538	2554	3514	1127	647	.....
Hay and Forage						
Total acres	2904	6114	3193	661	712	Hay 1
Tons	2116	5743	3719	823	741	1
Sweet Potatoes						
Acres	275	522	560	305	427	430
Bushels	19006	64101	42702	25588	29378	34157
Cotton						
Acres	10586	11682	22932	19793	18576	13497
Bales	3778	3218	6366	8370	4964	5757
Sorghum for Syrup						
Acres	275	762	167	500	237	.....
Gallons	.....	35958	7360	34822	32143	29798
Cane for Syrup						
Acres	38	292	317	116	137	24
Gallons	.....	22808	30478	16744	13527	2641
Number of Orchard Trees						
Apples	10115	7768	14763	7342	5524	.....
Peaches	23610	16470	45158	17550	11740	.....
Pears	2096	1418	1900	937	58	.....
Nuts	460	207	181	8	.....	.....
Expended for fertilizer	$32778	$21967	$37089	$7500	$5362	$395

Table B—FARM MORTGAGE DEBT—CHOCTAW, LEE AND LAUDERDALE COUNTIES AND STATE OF MISSISSIPPI—1925, 1920 AND 1910 FROM FEDERAL CENSUS DATA

Item and Year	Choctaw Co.	Lee County	Lauderdale Co.	State of Miss.
All Farms Operated by Owners				
Total Number 1925	1256	1443	1597	80808
1920	1442	1483	1676	91310
1910	1563	1594	1905	92066
No. Reporting Mortgage				
Debt 1925	337	435	411	26750
1920	396	426	374	23996
1910	548	530	556	29693
Per cent of Total.. 1925	26.8	30.1	25.7	33.1
1920	27.5	28.7	22.3	26.3
1910	35.1	33.2	29.2	32.3
Farms Operated by Full Owners				
Total Number 1925	1161	1262	1466	74541
1920	1355	1310	1562	83768
1910	1374	1405	1731	82475
No. Reporting Mortgage				
Debt 1925	304	396	374	24571
1920	336	372	335	21844
1910	407	392	454	22844
Value (land & buildings)				
Dollars 1925	4[illegible]966	1506765	925650	121061158
1920	735691	1524215	857825	99148925
1910	485942	831777	749290	42266412
Amt. Mortgage, dol. 1925	206636	655469	330646	49828709
1920	230770	599535	274533	30046272
1910	138874	301319	211941	13381396
Ratio of Debt to Value				
Percent 1925	41.8	43.5	35.7	41.2
1920	31.4	39.3	32.0	30.3
1910	28.6	36.2	28.3	31.7
Average per Mortgaged Farm 1925				
Val. of Land and Buildings				
Dollars	1625	3805	2475	4927
Mort. debt, dol. ...	680	1655	884	2028
Average per Acre 1925				
Value of land and buildings				
Dollars	12.32	52.30	17.66	35.21
Mort. debt, dol.	5.15	22.75	6.31	14.49
Average Interest Rate—				
Per cent 1920	6.6	6.7	6.4	6.5

TABLE C—FARMS REPORTING SPECIFIED CROPS—FEDERAL CENSUS—1925 AND FARM SURVEY 1929—CHOCTAW COUNTY

Item	121 Farm Survey Records—1928 Crop		1957 Farms of Agricultural Census—1924 Crop	
	Number Reporting	Percent of Total	Number Reporting	Percent of Total
Corn for all purposes	120	99.2	1702	87.0
Winter wheat	.....	.....	7	.4
Cowpeas	14	11.6	365	18.7
Peanuts	6	5.0	395	20.2
Velvet beans	.....	.....	106	5.4
Hay, sorghum, soybeans and oats	102	84.3	1475	87.1
Cotton	118	97.5	1496	76.4
String beans & other truck crops	13	10.3	78	4.0
Sugar cane for syrup	40	33.1	134	6.8
Tobacco	.....	.....	1	.....
Potatoes, white	4	3.3	44	2.2
Potatoes, sweet	69	67.0	559	28.9

TABLE D—ASSESSMENT OF CHOCTAW COUNTY—1916-1928—FROM REPORTS OF THE STATE TAX COMMISSION

Item and Unit	1916	1917	1918	1919	1920	1921	1922	1925	1924	1925	1926	1927	1928
Tot. No. Poll Tax	2594	2186	2100	*1	2114	4471	4139	3806	3771	3930	3858	3763	4237
No. White male	1926	1675	1578	*1	1584	1684	1598	1551	1565	1630	1613	1635	1712
No. Female	.....	.....	.....	....	.....	1678	1486	1446	1387	1383	1369	1367	1615
No. Negro male	668	511	522	*1	530	541	512	481	452	460	469	437	489
No. female	.....	.....	.....	....	.....	568	543	378	367	457	402	324	421
No. Com. Rd. Tax	1914	1577	1561	*1	1624	1756	1715	1524	1484	1576	1583	1496	1645
Classes of Presonal Property													
No. Sheep & Goats, exempt	508	514	528	*1	732	486	443	362	304	229	174	94	.....
No. taxed	.....	7	.....	*1	36	29	10	4	30	10	12	12	.....
Assessed valuation	.....	10	.....	*1	95	45	10	10	40	25	25	25	.....
Average valuation	.....	1.42	.....	*1	2.64	1.55	1.00	2.50	1.33	2.50	2.10	2.08	.....
No. Hogs, exempt	5429	4869	5640	*1	6088	4166	3316	3518	3393	2766	3132	4036	3775
No. Taxed	4	15	.....	*1	51	13	.....	2	.....	10	.....	.....	.....
Assessed valuation	19	110	.....	*1	665	80	.....	20	.....	80	.....	.....	.....
Average valuation	2.50	7.33	.....	*1	12.85	6.16	.....	10.00	.....	8.00	.....	.....	.....
No. mules, horses & asses exempt	620	622	622	*1	813	524	451	393	408	333	266	196	149
No. taxed	3744	3388	3196	*1	3707	3837	3649	3483	3460	3489	3464	3390	3345
Assessed valuation	257420	230775	249200	*1	337905	247555	186220	179985	163230	187050	153705	138305	154695
Average valuation	68.76	68.12	77.97	*1	91.15	64.52	51.05	51.68	47.18	53.61	44.37	40.80	46.22
No. cattle exempt	4458	5822	6099	*1	7719	5590	6171	6056	6883	6142	5903	5527	5239
No. taxed	1536	527	704	*1	570	787	897	656	631	364	252	243	294
Assessed valuation	13730	7710	13425	*1	12940	9225	7105	6205	4430	2835	2600	2945	5010
Average valuation	10.27	14.62	19.06	*1	22.70	11.81	8.08	8.46	7.02	7.79	10.32	12.12	17.04
No. Oxen taxed	69	74	73	*1	138	55	53	82	56	10	4	4	4
Assessed valuation	1995	3010	3170	*1	5590	1500	890	1565	1020	220	100	60	110
Average valuation	28.91	40.67	43.42	*1	40.51	27.28	16.80	19.08	18.21	22.00	25.00	15.00	27.50
No. Jacks & Stallions taxed	*2	*2	*2	*1	12	7	6	10	6	3	6	6	6
Assessed valuation	.....	.....	.....	*1	2425	1530	1575	1475	875	300	315	280	350
Average valuation	.....	.....	.....	*1	202.10	218.16	262.50	147.50	145.83	100 00	52.50	46.67	58.33
No. automobiles taxed	38	60	66	*1	171	248	257	302	419	544	798	998	1046
Assessed valuation	9850	14970	18325	*1	65560	63660	44615	43550	63080	92915	137045	140910	156435
Average valuation	259.21	249.50	277.65	*1	383.40	256.70	173.60	144.20	150.55	170.80	171.74	141.19	149.56
No. wagons, carts, hearses, etc., taxed	1915	1794	6101	*1	1847	1843	1551	1426	1402	1402	1309	1095	1017
Assessed valuation	30880	29760	31150	*1	56555	44280	30335	29520	29905	26815	24200	20440	19565
Average valuation	16.12	16.58	19.46	*1	30.62	24.02	19.56	20.70	21.53	19.09	18.49	18.67	19.24

No. Motorcycles, carriages etc., taxed	.....	.....	.....	*1	10	.....	.....	.....	.....	4	.....	1	2
Assessed valuation	.....	.....	.....	*1	370	.....	.....	.....	.....	55	.....	100.00	65
Average valuation	.....	.....	.....	*1	37.00	.....	.....	.....	.....	13.75	.....	100.00	32.50
No. Pianos taxed	*3	116	113	*1	110	125	101	96	109	218	135	133	134
Assessed valuation	.....	14135	14235	*1	16170	14670	11145	9065	11885	11630	12840	12000	11755
Average valuation	.....	121.85	126.00	*1	147.00	117.30	110.35	135.30	109.04	53.35	95.11	90.22	87.72
Other musical inst., taxed	276	185	158	*1	232	253	205	208	128	119	176	178	197
Assessed valuation	16810	4025	3660	*1	7615	6850	4550	5300	4940	4990	4165	4165	4205
Average valuation	60.90	21.75	23.17	*1	32.28	27.08	22.20	25.48	21.72	41.93	23.66	23.40	21.35
No. guns & weapons, taxed	46	51	38	*1	46	45	44	44	47	64	52	53	44
Assessed valuation	325	365	260	*1	470	430	360	350	375	480	430	405	430
Average valuation	7.07	7.16	6.85	*1	10.22	9.56	8.18	7.95	7.98	7.50	8.27	7.64	9.77
No. watches & clocks, taxed	90	100	103	*1	110	57	54	54	58	51	58	52	59
Assessed valuation	880	885	915	*1	1105	600	495	500	655	645	540	475	700
Average valuation	9.77	8.85	8.88	*1	10.05	10.53	9.17	9.26	11.29	12.65	9.31	9.18	11.86
Assessed valuation in dollars													
Diamonds & diamond jewelry	120	360	10	*1	825	450	125	300	825	650	950	1275	1600
Other jewelry	.....	20	200	*1	.....	180	.....	.....	.....	.....	15	100	.....
Household furniture	.....	.....	.....	*1	1000	700	500	550	1350	400	550	450	350
Heating systems, water systems, etc.	.....	.....	.....	*1	2590	2165	550	.....	.....	290	.....	175	.....
Office and store fixtures and equipment	1185	2485	5320	*1	3985	6780	3835	3595	4925	1835	1670	2560	4670
Mer. & stocks of goods	89890	75050	86945	*1	116420	93315	68495	74580	71655	77120	88995	85445	97475
Machinery, tools, etc.	.....	26095	68745	*1	75345	55605	56055	55005	60760	58830	74360	70680	56546*
Articles manufactured by party assessed	.....	2600	9340	*1	32090	8350	8450	9185	28600	36295	32810	31390	24305
Raw mat. for manuf.	.....	25	.....	*1	4315	1100	3050	6955	11900	33800	2375	6070	150
Public utility equipment	.....	260	100	*1	.....	.....	.....	.....	.....	260	8500	23605	110
Debts owing tax payer bearing over 6% int.	21900	11805	5760	*1	5170	340	1150	2200	200	200	.....	.....	500
Money on hand in bank	4290	3000	7330	*1	7010	.....	140	2800	.....	.....	.....	.....	.....
Stocks and bonds of foreign corporations	1800	.....	.....	*1	810	.....	.....	.....	.....	.....	.....	.....	.....
Agricultural implements (over $2000) & Misc.	.....	.....	.....	*1	.....	.....	.....	.....	.....	.....	.....	.....	815
*4 Corporations, capital stock over tax assess.	38075	25170	3665	*1	2500	.....	2390	.....	.....	55	6000	.....	.....
Banks, capital stock, etc., less real estate	36700	37000	35125	*1	67535	63250	20000	37190	30585	29400	32635	28745	31210
Total val. sub. to tax	52586	489625	556780	563300	827050	622660	452040	469905	491235	567475	584825	570605	570950

Real Property													
Cultivatable lands, acres	58967	56797	56797	51942	51942	44050	44050	39920	39920	38922	37902	37902	40278
Assessed valuation	171615	445240	445240	367355	367355	303150	303150	264830	264830	252905	245880	245880	291415
Average valuation	2.91	7.83	7.83	7.07	7.07	6.88	6.88	6.63	6.63	6.50	6.49	6.49	7.24
Buildings and improvements													
assessed valuation	*5	*5	*5	284495	284495	283230	283230	253175	253175	249225	240635	240635	264075
Average valuation	.....	.....	.....	.....	.....	.....	.....	12.98	12.98	12.90	12.84	12.84	13.79
Timbered lands, acres *6	203063	204889	204889	3295	3295	1400	1400	.....	.....	.....	.....	.....	11814
Assessed valuation	558931	718590	718590	10710	10710	5120	5120	90	90	.....	.....	.....	39125
Average valuation	2.75	3.50	3.50	3.25	3.25	3.65	3.65	.....	.....	.....	.....	.....	3.31
Timber, 100 feet													
board measure	575	.....	.....	6145	6145	2200	2200	*1	*1	5970	20225	20225	21915
Assessed valuation	575	.....	.....	8100	8100	1950	1950	2935	2935	22415	41010	41010	46790
Average valuation	1.00	.....	.....	1.32	1.32	.89	.89	.....	.....	3.79	2.03	2.03	2.14
Uncultivatable lands, acres ..	.....	.....	.....	206680	206680	216836	216836	217831	217813	223896	224542	224542	208977
Assessed valuation	.....	.....	.....	611695	611695	652380	652380	646380	646380	640995	647185	647185	688225
Average valuation	.....	.....	.....	2.95	2.95	3.01	3.01	2.97	2.97	2.86	2.86	2.86	3.29
Real estate in cities.													
Assessed valuation	75490	96350	96350	87080	87080	81880	81880	82890	82890	82490	82520	82520	87095
Imp. assessed valuation	211170	238940	238940	235010	235010	251400	251400	243590	243590	235055	230795	230795	263415
Total real estate, acres	*1	*1	*1	261917	261917	262286	262286	257733	257733	262818	262444	262444	261069
Assessed valuation	1017781	1499120	1499120	1604445	1604445	1579110	1579110	1493890	1493890	1483085	1488025	1488025	1680140
Railroads and Public Service Corporations													
Assessed valuation	452856	621156	564933	564369	622482	597660	598176	601618	600930	651542	615770	628078	648798
Per. brought forward	525860	489625	556780	563300	827050	622660	452040	469905	491235	567475	584825	570605	570950
Grant total assessment	1996497	2609901	2620833	2732114	3053977	2799430	2629326	2565413	2586055	2702102	2688620	2686708	2899888

*1 Not reported.
*2 Included with horses, mules and asses.
*3 Included with other musical instruments
*4 Includes "other" personal property for 1916, 1917, 1918, and 1919.
*5 Not separately reported.
*6 Includes uncultivatable lands prior to 1919.
* Includes filling station fixtures and equipment.

TABLE E—THE LAND DRAINAGE SITUATION, CHOCTAW COUNTY—1920 FROM THE U. S. CENSUS

Item	Total farms in County	Farms having drainage	Farms needing drainage	Farms in drainage and levee districts
Number of farms	2188	335	702	126
Number of acres	228010	9496	52790	.....
Acres improved	75416	.....	.....	.....
Acres needing drainage only	.....	.....	3384	.....
Acres woodland	124750	.....	.....	.....
Acres needing drainage and clearing	.....	.....	49406	.....
Acres, other unimproved	27844	.....	.....	.....

Total assessed acreage in drainage districts	14975
Acres improved	6433
Percent improved	43
Capital invested to December 31, 1919	$100209.00
Average per acre, based on total	6.69
Average per acre, based on improved	15.56

Of 6433 acres improved, 4936 acres or 76.7 per cent has been improved since drainage.
Total length of ditches in county—40.6 miles.

TABLE F—PRIVILEGE TAX LICENSES ISSUED IN CHOCTAW COUNTY—CALENDAR YEAR 1928 *1

	No.	Amount		No.	Amount
Auto accessories	14	$70.00	Lunch stands	5	$20.00
Auto dealers	7	225.00	Meat markets	1	5.00
Auto repairs	12	180.00	Moving picture shows	6	39.00
Battery stations	2	10.00	Near cider dealers	1	7.50
Barber shops	4	20.00	Non-alcoholic drinks	27	125.00
Bill posters	1	7.50	Oil depots	12	370.00
Blacksmith shops	3	15.00	Oil wagons	10	180.00
Bottling establishments	1	150.00	Peddlers	7	142.50
Car service	6	30.00	Photograph galleries	1	5.00
Cigarette dealers	29	437.50	Physicians	12	230.00
Cleaning	1	7.50	Planing mills	1	5.00
Coca-Cola dealers	24	187.50	Pressing	1	5.00
Coffins	3	75.00	Restaurants	9	55.00
Cotton weighers	1	10.00	Saw mills	19	195.00
Cottonseed buyers	2	20.00	Shingle mills	2	5.00
Creameries	2	20.00	Shows	7	102.00
Dentists	1	10.00	Shoe repair shops	2	10.00
Drays	3	10.00	Soda fountain	10	37.50
Electric light Co.	1	50.00	Stallions	3	30.00
Engineers	1	50.00	Stave factory	78	600.00
Gas pumps	49	290.00	Talking machines, dealers	2	70.00
Hotels	1	20.00	Telephone exchanges	2	20.00
Ice cream factories	1	50.00	Vending machines	1	7.50
Ice factories	1	50.00	Weighing machines	2	2.00
Lawyers	2	20.00			
			Total		$4283.00 *2

*1 Supplied by the Hon. Carl C. White, State Auditor.

*2 This amount collected by the State. The privilege taxes collected for the county, which includes auto license tags, are shown in Table 11.

TABLE G—EXPENSES—CHOCTAW COUNTY AGRICULTURAL HIGH SCHOOL TO NEAREST DOLLAR—TERMS OF 1927-8, 1926-7 AND 1925-6

Item	1927-1928	1926-1927	1925-1926
	Dollars	Dollars	Dollars
Teachers' Salaries	5670	5830	5128
Superintendent's Salary *1	1570	1570	1570
Labor on Farm	278	409	318
Janitor Supplies	59	177	.....
Fuel	72	39	135
Insurance	145	183	134
Repairs	24	.....	.....
Equipment and Buildings	612	40	278
Trustees' Salary	105	69	81

Operating Dormitory	636	400	.....
Feed Purchased	10	40	48
Fertilizer Purchased	.....	50	192
Interest on Loans	.....	40	205
Machinery and Livestock	.....	.....	1264
Library	.....	.....	38
Totals	9181	8847	9391

*1 Part prorated to A. H. S.

TABLE H—EXPENSES—WEIR CONSOLIDATED SCHOOL TO NEAREST DOLLAR—TERMS OF 1927-8, 1926-7 AND 1925-6—CHOCTAW COUNTY

Item	1927-1928	1926-1927	1925-1926
	Dollars	Dollars	Dollars
Teachers' Salaries	7480	6590	5760
Transportation of Pupils	2800	2254	2920
Fuel	450	105	518
Repairs	512	108	202
Equipment	161	1115	590
Library	.....	50	.....
Supplies	40	205	162
Janitor and Janitor's Sup.	129	128	92
Insurance	103	65	100
Totals	11675	10620	10344

TABLE I—EXPENSES—CONSOLIDATED SCHOOLS TO NEAREST DOLLAR—TERMS OF 1927-28, 1926-27 AND 1925-26—CHACTAW COUNTY

Name of School	1927-1928		1926-1927		1925-1926	
	Teachers' Salaries	Transportation	Teachers' Salaries	Transportation	Teachers' Salaries	Transportation
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Hebron	1290	1458	1285	1185	1230	1191
Progress	1740	612	1740	525	1660	960
Reform	2070	2082	1660	2055	1689	1890
Byway	1460	795	1240	675	1240	731
Fellowship	1290	720	862	480	795	240
Chester	2660	1815	3070	2168	2580	2600
Salem	495	150	390	.....	625	225
Simpson	1680	1308	1650	1272	1518	1050
High Point *1	780	240	780	136	765	248
Union	1290	598	1270	668	1134	480
French Camp *1	2400	1240	2400	1130	1860	990
Bond	1585	1277	1500	1240	.....	.....
Huntsville *1	450	246	352	270	324	240
Mathiston *1	400	.....	300	.....	300	.....
A District *2	600	360	264	210	.....	.....
Mount Airy *2	390	186	405	.....	450	.....
Fulcher	1200	780	.....	.....	.....	.....
Mabus Chapel *3	810	450	.....	.....	.....	.....
Totals	22530	14317	19168	12014	16170	10245

*1 Line School. Teaching cost prorated to show cost to Choctaw County.
*2 Pupils transferred to Sturgis, Oktibbeha County. Tuition in lieu of salaries.
*3 Pupils transferred to Ackerman. Tuition in lieu of salaries.

TABLE J—EXPENSES—WHITE GRAMMAR SCHOOLS, UNCONSOLIDATED TEACHERS' SALARIES TO NEAREST DOLLAR—TERMS 1927-8, 1926-7 AND 1925-6 CHOCTAW COUNTY

Name of School	Teachers' Salaries 1927-28	Teachers' Salaries 1926-27	Teachers' Salaries 1925-26
	Dollars	Dollars	Dollars
Asherville	450	390	345
Bluff Springs	390	388	375
Busby	390	412	365
Dry Creek	330	350	330
Fentress	1680	1388	1680
Gillis	345	350	315
Grange Hall	195	420	388
Hogan's Chapel	390	390	345
Hobson	420	390	420
Lewis Chapel	360	382	342
Noxubee Grange Hall	420	420	405
Power	375	365	375
Providence	390	390	360
Show	360	238	351
Vowell	825	780	735
Rome Center *1	180	150	205
Totals	7500	7205	7336

*1 Line School—50% Expense to Choctaw. Salaries prorated.

TABLE K—NEGRO GRAMMAR SCHOOLS, UNCONSOLIDATED TEACHERS' SALARIES TO NEAREST DOLLAR—TERMS OF 1927-8, 1926-7 AND 1925-6—CHOCTAW COUNTY

Name of School	Teacher's Salaries 1927-1928	Teachers' Salaries 1926-1927	Teachers' Salaries 1925-1926
	Dollars	Dollars	Dollars
Berry Thomas	162	137	130
Bethlehem	170	162	152
Big Jerusalem	175	208	138
Chapel	135	100	130
Cork	131	127	124
Davis	125	125	114
Fentress	.....	.....	133
Head	130	138	143
Hopewell	135	128	127
High Point *1	.....	.....	75
Little Jerusalem	150	179	133
Kennedy	250	139	131
Killough	163	203	175
Lanthrip	135	134	124
Miller	150	141	127
Mt. Olive	150	140	140
Pleasant Hill	125	154	125
Pilgrim Rest	150	162	144
Reform	150	130	148
Rocky Hill	327	196	168
Rock Port	323	251	307
Little Rock	100	100	.....
Mt. Salem	147	130	150
Spay	605	578	419
Sunrise	150	130	146
Thompson	150	.....	.....
Weir	960	720	690
Pinderville	140	185	149
McMullen	140	150	147
Boyd	.....	.....	726
Totals	5628	4948	4855

*1—Line School. Salary prorated.

TABLE L—CONSOLIDATED SCHOOLS: GRADES TAUGHT, LENGTH OF TERM, NUMBER OF TEACHERS, AND AVERAGE ATTENDANCE OF PUPILS—TERMS OF 1927-8, 1926-7 AND 1925-6—CHOCTAW COUNTY

Name of School	Grades Taught	1927-28 Months' Term	1927-28 Teachers	1927-28 Attendance	1926-27 Months' Term	1926-27 Teachers	1926-27 Attendance	1925-26 Months' Term	1925-26 Teachers	1925-26 Attendance
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Wier	8	8	9	300	8	8	250	8	8	230
Hebron	10	6	2	100	6	3	93	6	3	86
Progress	10	8	3	98	8	3	106	8	3	120
Reform	10	6	5	183	6	4	151	6	4.25	157
Bywy	10	6	3	126	6	3	109	6	3	102
Fellowship	9	6	3	99	6	2	78	6	2	56
Chester	11	6	6	201	7	6	214	7	6	190
Salem	8	6	2	50	6	1	28	6	2	56
Simpson	10	6	4	130	6	4	128	6	4	123
High Point *1	10	8	1	45	8	1	46	8	1	47
Union	9	6	3	120	6	3	96	6	3	91
French Camp *1	8	8	4	162	8	4	164	8	3.2	118
Bond	9	6	4	128	6	4	121	..	..	
Huntsville	8	6	1.5	35	6	1.5	40	6	1.5	56
Mathiston *1	8	6	1	42	6	1	22	6	1	24
A Dist. *2	12	6	1	40	6	1	18	..	..	
Mt. Airy *2	12	6	1	35	6	1	35	6	1	40
Fulcher	12	9	2	68	..	..				....
Mabus Chap. *3	12	9	1.5	45	..	.....		..	..	.....
Totals	....	..	58	2007	..	50.5	1699	..	46	1476

*1 Line School—Number of Teachers prorated.
*2—Pupils transferred to Sturgis. Number of Teachers prorated.
*3—Pupils transeferred to Ackerman. Number of Teachers prorated.

TABLE M—WHITE GRAMMAR SCHOOLS—UNCONSOLIDATED—EIGHT GRADES TAUGHT —LENGTH OF TERM, NUMBER OF TEACHERS AND AVERAGE ATTENDANCE OF PUPILS—TERMS 1927-8, 1926-7 AND 1925-6—CHOCTAW COUNTY

Name of School	1927-1928 Mos. Term	1927-1928 Teachers	1927-1928 Attendance	1926-1927 Mos. Term	1926-1927 Teachers	1926-1927 Attendance	1925-1926 Mos. Term	1925-1926 Teachers	1925-1926 Attendance
	No	No.	No.	No.	No.	No.	No.	No.	No.
Asherville	6	1	33	6	1	31	6	1	29
Bluff Springs	6	1	36	6	1	30	6	1	24
Busby	6	1	25	6	1	38	6	1	38
Dry Creek	6	1	19	6	1	16	6	1	15
Fentress	8	3	76	8	3	68	8	3	76
Gillis	6	1	30	6	1	28	6	1	28
Grange Hall	6	1	10	6	1	22	6	1	25
Hogan's Chapel	6	1	20	6	1	24	6	1	30
Hobson	6	1	40	6	1	32	6	1	28
Lewis Chapel	6	1	18	6	1	16	6	1	21
Noxubee Grange Hall	6	1	18	6	1	28	6	1	22
Power	6	1	20	6	1	20	6	1	15
Providence	6	1	15	6	1	15	6	1	13
Show	6	1	10	6	1	11	6	1	22
Vowell	6	2	60	6	2	54	6	2	48
Rome Center *1	6	.5	10	6	.5	19	6	.5	11
Totals	..	18.5	440	..	18.5	452	..	18.5	445

*1—One Teacher, line school—Teacher prorated.

TABLE N—NEGRO GRAMMAR SCHOOLS—UNCONSOLIDATED: LENGTH OF TERM, NUMBER OF TEACHERS AND AVERAGE ATTENDANCE OF PUPILS—TERMS 1927-8, 1926-7 AND 1925-6—CHOCTAW COUNTY

Name of School	1927-1828			1926-1927			1925-1926		
	Mos. Term	Teachers	Attendance	Mos. Term	Teachers	Attendance	Mos. Term	Teachers	Attendance
	No.	No.	No.	No.	No.	No.	No.	No.	No.
Berry Thomas	5	1	23	5	1	23	5	1	24
Bethlehem	5	1	53	5	1	36	5	1	51
Big Jerusalem	5	1	27	5	1	42	5	2	46
Chapel	5	1	44	4	1	35	5	1	40
Cork	5	1	43	5	1	40	5	1	43
Davis	5	1	28	5	1	23	5	1	23
Fentress	--	--	---	--	--	---	5	1	34
Head	5	1	46	5	1	34	5	1	32
Hopewell	5	1	27	5	1	24	5	1	40
Highpoint *1	--	--	----	--	--	----	5	.5	8
Little Jerusalem	5	1	22	5	1	33	5	1	31
Kennedy	5	2	46	5	1	41	5	1	39
Killough	5	1	50	5	1	38	5	1	45
Lanthrip	5	1	24	5	1	23	5	1	13
Miller	5	1	47	5	1	58	5	1	37
Mt. Olive	5	1	13	5	1	15	5	1	26
Pleasant Hill	5	1	27	5	1	41	5	1	32
Pilgrim Rest	5	1	41	5	1	50	5	1	41
Reform	5	1	40	5	1	25	5	1	34
Rocky Hill	5.5	2	51	5.5	1	48	5	1	40
Rock Port	5	2	79	5	2	70	5	2	100
Little Rock	5	1	30	5	1	20	--	--	----
Mt. Salem	5	1	43	5	1	42	5	1	37
Spay *2	5.5	3	104	5.5	3	192	5	3	112
Sunrise	5	1	26	5	1	18	5	1	29
Thompson	5	1	25	--	--	----	--	--	----
Weir *2	6	4	164	6	3	123	6	3	137
Pinderville	5	1	40	5	1	40	5	2	65
McMullen	5	1	32	5	1	20	5	1	28
Boyd	--	--	----	--	--	----	5	1	32
Totals	--	35	1195	--	31	1154	--	35	1219

*1—Line School, One teacher, prorated.
*2—Nine Grates Taught.

TABLE O—COPY OF UNIFORM ANNUAL REPORT FOR YEAR ENDNIG SEPTEMBER 30, 1929—CHOCTAW COUNTY, MISSIISSIPPI

Revenue Aeceipts	Amount	Governmental Costs	Amount
	Dollars		Dollars
General Property Tax	243100.83	Administrative	19442.96
Gasoline Tax	23379.16	Judicial	4917.30
Privilege Tax	14844.10	Prot. of Person & Property	662.00
Interest	1567.61	Conservation of Health	510.00
Rents	2084.92	Highway Maintenance	134341.39
Licenses and Permits	1003.75	Charities and Corrections	1655.46
Fines and Forfeits	921.00	Educational	107079.69
State Appropriations	95390.28	Miscellaneous	None
Departmental Earnings	None	Interest on Temporary Loans	5871.98
Sales of Property	377.00	Interest on Bonds	30372.00
Miscellaneous Receipts	640.46		
Total Revenue Receipts	383309.11	Total Government Costs	304852.78
Non-Revenue Receipts		Non-Governmental Costs	
Temporory Loans	26916.50	Temporary Loans	68639.11
Bonds	None	Bonds	13650.00
Prem. & Accrued Interest	None	Permanent Improvements	None
Advances and Deposits	None	Transfers and Refunds	4250.66
Transfers and Refunds	4250.66	Trust & Investment Transactions	None
Trust & Investment Transactions	None		
Total Non-Revenue Receipts	31167.16	Total Non-Governmental Costs	86539.77
Total Receipts	414476.27	Total Disbursements	391392.55
Bal. on hand, beginning of period	47417.76	Bal. on hand, end of period	70101.48
Grand Total	461494.03	Grand Total	461494.03

BULLETIN No. 283 JULY, 1930

Grazing & Feeding Trials With Corn and Soybeans for Pork Production

By

P. G. BEDENBAUGH

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. COLLEGE, MISSISSIPPI
J. R. RICKS, Director

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SUMMARY

Satisfactory gains were made when grazing on the Mammoth Yellow beans alone.

Supplementing beans with corn increased the daily gains.

Supplementing beans with corn will enable earlier marketing which is generally more desirable.

The Mammoth Yellow bean was noted to be much more palatable than the Laredo.

When the pigs were supplied either Mammoth Yellow or Laredo beans with corn, sufficient amounts of the beans were consumed to aid materially in balancing the corn ration.

Larger daily gains were made when using the Mammoth Yellow bean for self-feeding and hogging down with corn than when using the Laredo in the same way.

The pigs made larger daily gains while hogging down corn and Mammoth Yellow beans than they did while being self-fed the same in dry lot; however, the reverse was true with corn and Laredo beans.

In the one test reported, in each lot the addition of a protein supplement to corn and beans increased the daily gains.

Grazing and Feeding Trials With Corn and Soybeans for Pork Production

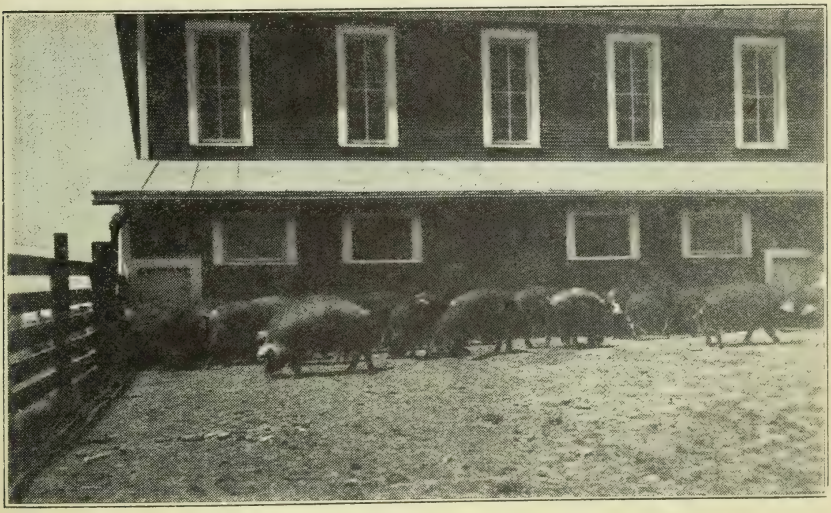
By
P. G. BEDENBAUGH*

INTRODUCTION

Realizing that the use of soybeans was rapidly increasing in the State, both as a soil improver and for the production of pork, experimental work was carried out at the Mississippi Experiment Station to try to determine the most desirable variety and economical way of utilizing the beans for the production of pork. Most of the trials conducted were with the Mammoth Yellow and Laredo beans, since they were two of the leading varieties being grown in the State.

PIGS USED AND PREVIOUS HANDLING

All pigs used in the following experiments were bred and raised on the Experiment Station farm and in each trial they had had the same care and feeding until the various trials were started. The practice was to worm and move the pigs on clean grazing lots as soon after weaning as possible. They were smooth, thrifty, and considered as good-to-choice feeder pigs. The breeding consisted of purebred Poland China, Duroc Jersey, and Hampshire, with some cross-breds of these breeds. At the beginning of each experiment, the pigs were divided into lots as nearly equal as possible in age, breeding, type, sex, quality, condition, and weight.



Type of Pigs Used in Feeding and Grazing Trials

*The work reported herein from 1923 to 1926, inclusive, was conducted under the supervision of Geo. S. Templeton.

SOYBEANS GRAZED ALONE AND WITH CORN—1923 AND 1924

The soybeans used in this test were the Mammoth Yellow variety. The beans were grown in the drill with corn in rows three and one-half feet apart. The corn was gathered the day before the test was started, care being taken to prevent any corn being left in the field. The estimated yield of beans per acre in the fall of 1923 was thirteen bushels.

The crop of 1924 was not planted until the first of May and there was very little rain from the latter part of May until the early part of November; consequently, the bean crop was very short. The ground was very dusty during the early part of the grazing period and the beans shattered out shortly after the hogs were turned on the bean field and they were forced to root the beans out of the dust. It will be noted that lower daily gains were made than in the previous year.

The following table gives a summary of the soybeans grown with corn, the corn gathered, and the beans grazed alone; also soybeans grazed plus two and one-half per cent corn hand fed daily. That is, the amount fed per day was two and one-half per cent of the live weight of the hogs in that lot.

Table 1.—Soybeans Grown with Corn, the Corn Gathered and the Beans Grazed; Also Beans Grazed, and Corn, Hand-Fed.

	1923		1924	
	Soybeans Grazed Alone	Soybeans Grazed plus 2½ per cent corn	Soybeans Grazed Alone	Soybeans Grazed plus 2½ per cent corn
Length of Trial	56	56	42	42
Number of Hogs Used	12	12	12	12
Average initial wt. (lbs.)	143	141	119	120
Average final wt, (lbs.)	206	232	155	184
Average daily gain per hog (lbs)	1.12	1.62	.86	1.53
Corn fed per cwt. of grain (lbs.)	—	287	—	250
Variety of beans grazed	Mammoth Yellow	Mammoth Yellow	Mammoth Yellow	Mammoth Yellow

Assuming that the equivalent in value of 500 pounds of corn is required to produce 100 pounds of gain, it will be noted in the above table that when the pigs were grazing on beans with 2½ per cent ration of corn hand-fed daily, the beans replaced 213 to 250 pounds of corn per hundred weight of gain. It will also be seen from Table 1 that in 1923, when the beans were plentiful, the daily gains were increased 44 per cent by adding corn. The following year when the beans were not so plentiful, adding corn increased the daily gain 78 per cent.

HOGGING DOWN CORN AND SOYBEANS—1926

In the fall of 1926, two groups of hogs were used to compare heavy and light weight hogs for hogging down corn and beans in order to make a study of the relative firmness of carcass as influenced by same. The soybean work was conducted cooperatively with the Bureau of Animal Industry, U. S. Department of Agriculture. Twenty head were spring farrowed pigs with an average initial weight of 127 pounds. Seventeen head were summer farrowed pigs with an average initial weight of 50 pounds.

The beans were grown together with corn in rows. By harvesting a

measured distance, consisting of several rows, an estimate of the crop yield was secured. The yield of corn grown with the Mammoth Yellow beans was estimated to be 44.7 bushels per acre and the yield of beans was 6.2 bushels per acre. The corn and beans were mature at the time the hogs were turned into the field. The hogs preferred the Mammoth Yellow beans and did not consume very much corn as long as the beans were plentiful. When the beans became scarce so that the hogs had to exert themselves to gather them, they consumed mostly corn.

Lot 1, consisting of 10 havy weight hogs, was on corn and Mammoth Yellow beans for a period of eight weeks. A second lot of 10 heavy weight hogs was on corn and Mammoth Yellow beans for four weeks.

Lot 3, consisting of 10 light weight pigs, grazed on corn and Mammoth Yellow beans for 56 days. Seven light weight pigs in Lot 4 grazed on corn and Mammoth Yellow beans for 28 days.

Each lot of pigs had free access to a mineral mixture composed of ten parts acid phosphate, ten parts air slaked lime, and two parts salt. The results are given in the following table:

Table 2.—Hogging Down Corn and Soybeans—1926

Lot	1	2	3	4
Number of days grazed	56	28	56	28
Number of hogs used	10	10	10	7
Average initial weight (lbs.)	130	124.1	49.3	51.3
Average final weight (lbs.)	206.9	170.4	104.2	75.4
Average daily gain per pig (lbs.)	1.37	1.65	.98	.86
Variety of beans grazed	Mammoth Yellow	Mammoth Yellow	Mammoth Yellow	Mammoth Yellow

It will be noted in the above table that in each instance the heavy weight pigs made the larger daily gains as was to be expected.

HOGGING DOWN CORN AND SOYBEANS—1927 AND 1928

Heavy and light weight pigs were used to make a weight study as well as to compare the palatability of Mammoth Yellow and Laredo beans.

The heavy weight pigs were divided into two lots, one grazing corn and Mammoth Yellow beans for six weeks, and the second lot on corn and Laredo beans for six weeks. The light weight pigs were likewise divided into two lots. One lot was turned on corn and Mammoth Yellow beans for eight weeks and the second lot grazed on corn and Laredo beans for eight weeks.

The yield of Mammoth Yellow beans grown with corn was estimated to be 5.1 bushels per acre and the estimated yield of Laredo beans grown with corn was 6.3 bushels per acre. This estimate was made by harvesting a small area of representative ground. The corn and beans were mature at the time the pigs were turned into the field. The hogs did not start breaking down the corn in the Mammoth Yellow bean field for several days. After going into the field and breaking down corn around the shade which was provided for them, it was noticed that the pigs continued to graze on Yellow beans for several days in preference to the corn which they had to pass over to get to the beans. However, during this time in the Laredo soybean field the pigs had broken down and consumed a considerable amount of corn.

The work of 1928 was a continuation of the variety study of Mammoth Yellow and Laredo beans. Two lots of twelve pigs each were used. One lot hogged down corn and Mammoth Yellow beans and the second lot hogged down corn and Laredo beans.

The corn and beans were grown together in the same row as usual and the crop was mature when the hogs were turned into the fields. No estimate of the crop yield was made however, it being apparently about the same yield as that of 1927. The relative palatability of the beans was noted to be about the same as during 1927.

MINERAL MIXTURE

Each lot of pigs, 1927 and 1928, had free access to a mineral mixture. However, no record was kept as to the amount consumed. The mineral mixture was as follows:

10 pounds acid phosphate; 10 pounds air slaked lime; 2 pounds salt.

The following table gives results of the two years' work:

Table 3.—Hogging Down Corn and Soybeans—1927 and 1928

Lot	1	2	3	4	5	6
Year	1927	1927	1927	1927	1928	1928
Number of days grazed	42	42	56	56	59	59
Number of hogs used	14	14	15	15	12	12
Avg. initial wt. (lbs.)	126.9	127	98 3	98	101.75	96.41
Avg. final wt. (lbs.)	230.85	220.92	194.2	186.8	206.75	175.60
Avg. daily gain per pig (lbs.)	2.47	2.23	1.71	1.58	1.77	1.34
Variety of beans grazed	Mammoth Yellow	Laredo	Mammoth Yellow	Laredo	Mammoth Yellow	Laredo

Lots 1 and 2, also Lots 3 and 4 are comparable in every respect except hogging down a different variety of beans with corn. In each instance, higher daily gains were made on the Mammoth Yellow beans.

It will also be noted from the above table that in 1928 the hogs made larger daily gains on the Mammoth Yellow beans.

SELF-FEEDING SHELLED CORN AND SOYBEANS FREE CHOICE AND HOGGING DOWN CORN AND SOYBEANS—1928

This year's work consisted of self-feeding shelled corn, whole soybeans and mineral mixture free choice in dry lot to compare the palatability of varieties and the relative effects of the beans on the gains of hogs. The work also included hogging down corn and soybeans with mineral mixture, using some of the same varieties of beans as were used in dry lot feeding to get a relative comparison of gains when hogging down versus self-feeding in dry lot.

They were fed as follows:

Lot 1. Check lot, self-fed shelled corn and tankage, free choice.

Lot 2. Self-fed shelled corn and Mammoth Yellow soybeans, free choice.

Lot 3. Self-fed shelled corn and Laredo soybeans, free choice.

Lot 4. Self-fed shelled corn and Manchu soybeans, free choice.

Lot 5. Self-fed shelled corn, Laredo and Mammoth Yellow soybeans, free choice.

Lot 6. Hogging down corn and Mammoth Yellow soybeans.

Lot 7. Hogging down corn and Laredo soybeans.

Lots 1, 2, 3, 4, and 5 were fed in dry lots. All lots had free access to

a mineral mixture. No record was kept as to the amount of mineral mixture consumed. The mixture was composed of:

10 pounds acid phosphate; 10 pounds air slaked lime; 2 pounds salt.

Table IV.—Self-feeding Shelled Corn and Soybeans, Free Choice, and Hogging Down Corn and Soybeans. September 30 to November 27, 1928—59 Days.

	1	2	3	4	5	6	7
od of feeding	Dry lot	Dry lot	Dry lot	Dry lot	Dry lot	Hogging Down	Hogging Down
on	Corn and Tankage	Corn and M. Yellow beans	Corn and Laredo beans	Corn and Manchu beans	Corn, Laredo & M. Yel. beans	Corn and M. Yellow beans	Corn and Laredo beans
ber of hogs	8	8	8	7	7	12	12
age initial wt. (lbs.)	101.87	101.25	101.75	101.14	102.57	101.75	96.41
age final wt. (lbs.)	217.62	187.25	186.37	175 00	177.57	206.75	175.60
age daily gain (lbs.)	1.96	1.45	1.43	1.25	1.27	1.77	1.34
consumed per 100 lbs. gain:							
Corn	311.77	229.65	271.93	315.08	277.33	—	—
Tankage (lbs.)	37.68	—	—	—	—	—	—
Mammoth Yellow beans (lbs)	—	112.50	—	—	104.57	—	—
Laredo Yellow beans (lbs.)	—	—	87.00	—	*0.0	—	—
Manchu Yellow beans (lbs.)	—	—	—	52.22	—	—	—
portion of corn to tankage	8.26:1	—	—	—	—	—	—
portion of corn to soybeans	—	2.04:1	3.12:1	6.03:1	2.74:1	—	—

*Only one pound of Laredo soybeans was consumed during the feeding test.

It is noted in this one test that when the soybeans were self-fed, the pigs relished them in the following order:

Mammoth Yellow, first
Laredo, second
Manchu, third.

Evidently the Laredo is not nearly so palatable as the Mammoth Yellow as is noted in Lot 5 where the pigs had free choice of the two varieties, they did not consume any of the Laredo beans.

It will be noted from the above table that the pigs in Lot 6, hogging down corn and Mammoth Yellow soybeans, gained more rapidly than the pigs in Lot 2, which were being self-fed the same variety of beans and corn.

By referring to Lots 3 and 7 it will be noted that larger daily gains were made when self-feeding corn and Laredo soybeans in dry lots than when hogging down same.

SELF-FEEDING GROUND CORN AND SOYBEANS AND THE FEEDING OF SAME WITH DIFFERENT PROTEIN SUPPLEMENTS—1929

In soft pork studies large variations have occurred in carcasses of hogs from the same lot; therefore, it was deemed necessary to know the exact proportion of corn to beans each individual pig consumed in order to try to determine the cause of variation in firmness of carcasses, and the only way to obtain such information necessitated the grinding and thorough mixing of the feeds in known proportions. Hence, this year's work was carried out on that basis.

This year's work consisted of the addition of a protein supplement to

the corn and soybean ration in order to see if same was profitable and if so, what source of protein supplement would give the most economical gains. All feeds were ground and mixed thoroughly in definite proportions. Each group of pigs was self-fed in dry lots and had free access to the following mineral mixture:

10 parts bone meal; 10 parts ground limestone; 2 parts salt.

They were fed as follows:

Lot 1. Corn, 6 parts and Mammoth Yellow soybeans, one part.

Lot 2. Corn, 6 parts and Virginia soybeans, 1 part.

Lot 3. Corn, 6 parts and Mammoth Yellow soybeans, 1 part plus 2 per cent protein by the addition of Marine Protein feed.

Lot 4. Corn, 6 parts and Mammoth Yellow soybeans, 1 part plus 2 per cent protein by the addition of dried buttermilk.

Lot 5. Corn, 6 parts and Mammoth Yellow soybeans, 1 part plus 2 per cent protein by the addition of cotton seed meal.

The results are given in the following table:

Table 5.—Self-Feeding Ground Corn and Soybeans and the Feeding of Same With Different Protein Supplements

Lot	1	2	3	4	5
Ration (Self-fed in dry lot)	Corn 6 parts Mammoth Yellow Beans 1 part	Corn 6 parts Virginia Beans 1 part	Corn 6 parts Mammoth Yellow Beans 1 part, M. P. F. 0.3 part	Corn 6 parts Mammoth Yellow Beans 1 part D. B. M. 0.4 part	Corn 6 parts Mammoth Yellow Beans 1 part, C. S. Meal 0.341 part
Number of hogs	10	10	10	10	10
Length of feeding trial (days)	63	63	56	56	56
Avg. initial wt. (lbs.)	96.8	96.5	99	99.1	98.7
Avg. final wt. (lbs.)	190.3	196.2	207.1	224.1	202.2
Avg. daily gain per hog (lbs.)	1.48	1.58	1.93	2.23	1.84
Feed consumed per 100 lbs. gain:					
Corn (lbs.)	325.72	322.00	282.24	269.42	292.10
Beans (lbs.)	54.28	46.00	47.03	44.90	48.68
Protein Supplement (lbs.)	—	—	14.10	17.96	16.63
Mineral Mixture (lbs.)	7.59	5.71	2.40	1.36	2.41

By referring to the above table, the following will be noted:

Lot 1, receiving Mammoth Yellow soybeans with corn, made an average daily gain of 1.48 pounds, requiring 380 pounds of concentrates to make 100 pounds of gain.

Lot 2, receiving Virginia soybeans, made a daily gain of 1.58 pounds per head, requiring 368 pounds of concentrates per 100 pounds of gain. The Virginia bean lot consumed 12 pounds less feed to make 100 pounds of gain and at the same time produced gains more rapidly.

As a protein supplement for increasing daily gains, the three supplements used in this test ranked as follows:

Dried Buttermilk
Marine Protein Feed
Cottonseed Meal

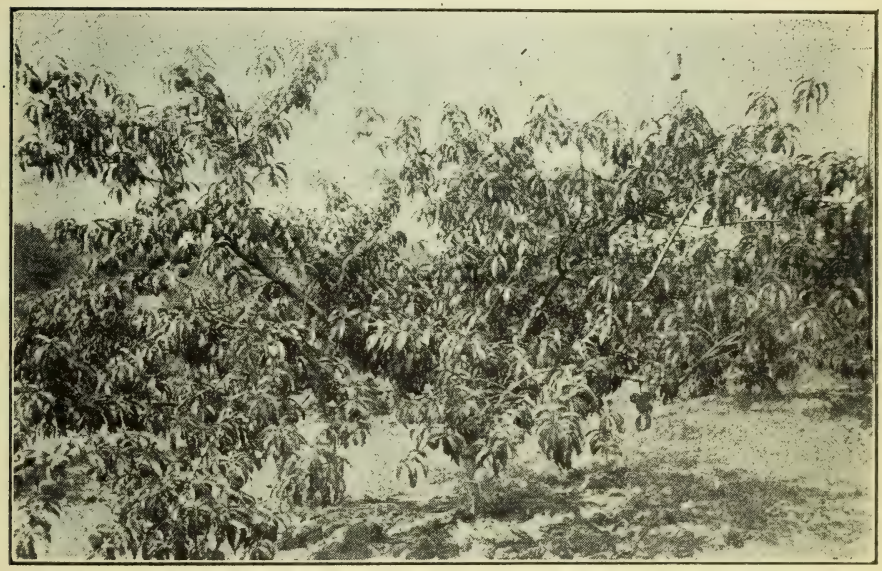
Bulletin 284 August, 1930

Varieties of Peaches

By

J. C. C. PRICE

Horticulturist



Mississippi Agricultural Experiment Station
J. R. Ricks, Director

INTRODUCTION

There are many varieties of peaches offered for sale, and the catalogue description of each variety tends to prove it a valuable variety. The purpose of this bulletin is to give the results obtained in testing thirty-three varieties. The varieties were planted 20 ft. by 20 ft. and given the same treatment throughout. Records were made of time of blooming, time of ripening, yield, resistance to disease, drouth and winter injury, quality, value, and use of fruit.

Note that varieties which proved exceptionally good are described in full, while those that are less important are described briefly.

Fig. 1. Alabama peach showing the 2-1 pack.

NEW PEACHES

ALABAMA—A seedling of Carman, grown from seed selected by author from a choice Carman tree. The tree is a vigorous grower, and a well formed, medium spreading tree of the same type as Carman. Foliage large, light green; wood light green. Very productive, and a regular bearer. Fruit large, roundish ovate, smooth, medium pubescence; surface, underlying color cream, overlying color heavily splashed and striped with red to deep carmen in the sun. Colors well in shade. Suture medium deep at stem end, extending practically to the apex, suture smooth. Sides of fruit practically symmetrical, apex round, with a very small point. Ripens uniformly throughout. Skin thin and tough; flesh firm, smooth grained, white streaked with red, firm as compared with Carman, although not as firm as Hiley. Quality very good for early fruit. A mild subacid, very juicy. Seed small, smooth, medium small pit, roundish globular shape, a semi-cling stone. A good keeper. Average ripening date, June 10.

GLADYS—A seedling originated by Wm. H. Thompson of Gunnison, Mississippi. Mr. Thompson states that this tree came up in his asparagus bed, bore several fine peaches the third year and has continued to bear without missing a crop. He says the tree produces less imperfect fruit than any in his orchard. Bud wood was secured from Mr. Thompson and budded on some seedlings, which were planted in the orchard. These trees were planted in missing places among the Hileys, Belles of Georgia and Elbertas. These trees bore in three years and have borne good crops each year.

The tree is a fairly vigorous grower, upright, spreading in habit, with heavy foliage of yellowish green color typical of yellow peaches. Flowers deep pink, and of medium size. Fruit large, smooth, medium pubescent. Color yellow, heavily splashed with red, very showy. Suture fairly deep and extends around peach; apex pointed. Skin medium thick, medium tough; flesh deep yellow, red at pit, firm, fine texture, tender, sweet, of very good quality. Seed small, fairly smooth. Keeps and ships well. Fruit very resistant to rot and other diseases. Average ripening date, July 16.

Fig. 2. The Lucy Bunn peach tree and its originators.

LUCY BUNN—A seedling originated in the yard of Mr. Harry Strong of West Point, Mississippi. The tree is a good grower, upright in habit, an early and prolific bearer. This

peach was called to the writer's attention nine years ago, and has been under observation in the Station orchard since 1921, at which time buds were taken from the original tree and grown on young trees. Fruit large, smooth, medium pubescent; color white with splashes of red, suture very deep, sometimes cracks; apex pointed. Skin medium thick, tough; flesh white, of fine texture, firm, tender, sweet, of excellent quality. Seed small. Fruit a good keeper and shipper. Average ripening date, July 16.

PRICELESS—A cross made by the author (Carman x Elberta) at the Alabama Station. Buds from the original tree were placed on young trees here. A very vigorous growing tree, medium spreading type, very productive, the tree resembling the Elberta. The foliage is heavy, of yellowish green color. Flowers are small, light pink, blooms very late. Fruit large, regular, smooth, medium pubescent; color white, with heavy splashes of carmen red; suture medium deep; apex small, blunt; skin medium thin, tough; flesh white with tinges of red, firm, tender, of fine texture, sweet, of excellent quality. A very good keeper and shipper. Fruit and tree rather resistant to disease. Average ripening date, July 4.

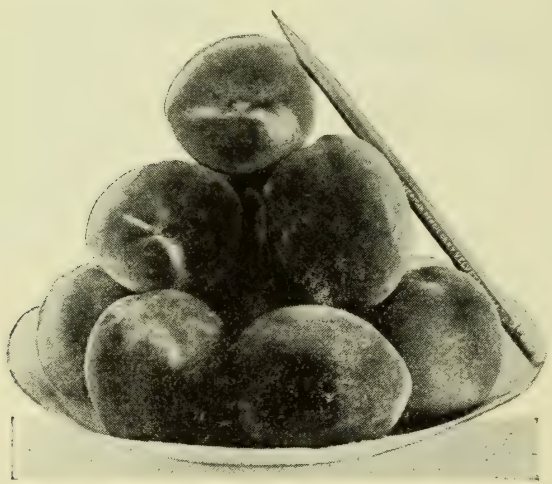


Fig. 3. The Priceless peach.

PEACHES FOR MAY

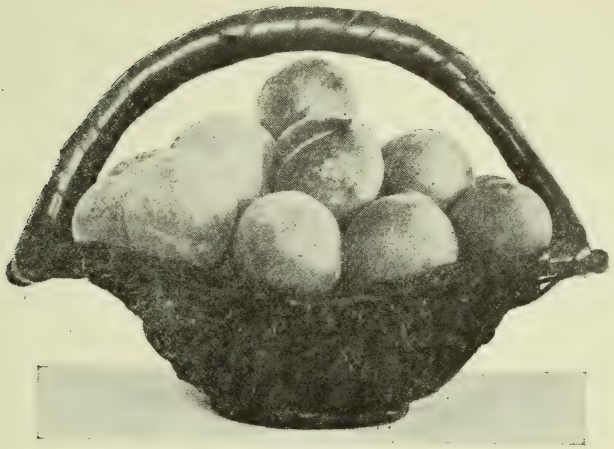


Fig. 4. A nice basket of Mayflowers.

MAYFLOWER—A fairly vigorous grower, inclined to grow thick, also to overbear. Requires severe pruning and thinning of fruit. Fruit medium sized, of good color, very showy; of poor quality, bruises easily, making it hard to handle. The best of May peaches. Average ripening date, May 25.

SNEED—A fairly vigorous grower of the low spreading type, a thick grower and a poor bearer. Fruit medium sized, greenish yellow in color, of very poor quality. Ripens three days after Mayflower.

PEACHES FOR JUNE

EARLY ROSE—A medium vigorous tree of spreading habit, very productive, a consistent bearer. Fruit medium to small, roundish conic; surface, smooth with a cream colored skin heavily splashed with red. Sides slightly uneven; suture medium, extending past the apex; apex slightly pointed, with a very small point; skin medium thick and tough; medium heavy pubescence. Flesh white, heavily streaked with red, fine grained, slightly stringy; firm; quality, fair to good; juicy, subacid, good keeper and shipper; Seed tight cling,

medium to small, smooth, roundish conic, with small point. An Indian type. Average ripening date, June 20.

GREENSBORO—A medium vigorous grower, of spreading habit, productive. Fruit medium sized, oblong, ripens at apex before it does at stem, making fruit undesirable to handle for market purposes. Ripens almost with Early Rose. Not recommended. Average ripening date, June 24.

JUNE ELBERTA—A vigorous grower, not productive. Has borne very few fruits in the Station orchard. Fruit large, showy, of good quality. Not recommended because of poor bearing. Average ripening date, June 24.

ARP BEAUTY—Tree is a vigorous, upright grower, very productive, and a regular bearer. Fruit medium to large, yellow with a deep crimson cheek on sun side. Fruit almost round in shape; skin medium thin, tough; flesh yellow, of good quality; keeps and ships well. Recommended for home use and for local markets. Average ripening date, June 28.

PEACHES FOR JULY

MAMIE ROSE—A medium vigorous grower, of spreading habit, medium produuctive, and a fairly regular bearer. Fruit medium to large, a white semi-cling type of very good quality. A splendid variety for home use. Average ripening date, July 7.

CARMAN—A very vigorous grower, of upright habit, with heavy foliage and large showy blooms, medium productive, and regular bearer, a late bloomer. Fruit large, showy, semi-cling type, with white flesh tinged with red; a mild subacid, of good quality. Recommended for both home and market use. Average ripening date, July 8.

Fig. 5. Hiley tree showing habit of growth.

HILEY—A medium vigorous grower with pronounced spreading habit, dense green foliage, an early bloomer (its worst fault), a heavy and regular bearer, inclined to overload, making thinning of fruit necessary. Fruit medium to large, white with heavy blushes and stripes of red over peach, very showy. Skin thin, tough; flesh firm, fine grained, tender. A mild subacid of excellent quality. The best peach for commercial and home use. Average ripening date, July 12.

EARLY CRAWFORD—A fairly vigorous grower of upright habit, medium productive, and not a regular bearer. Fruit large, yellow and of good quality. Many fruits have to be culled because of ill shape. Not desirable. Average ripening date, July 1.

LATE CRAWFORD—A medium vigorous tree, of upright habit, a poor producer. Fruit large, yellow, and of good quality. Not recommended because of light production. Average ripening date, July 12.

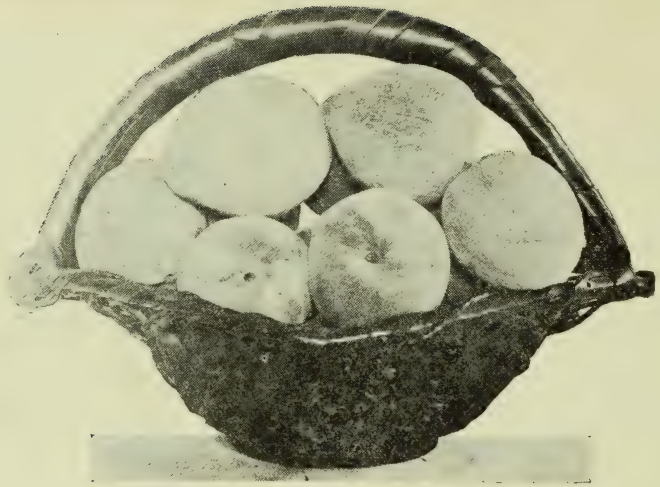


Fig. 5. The Belle of Georgia.

BELLE OF GEORGIA—A medium vigorous grower, of medium spreading habit, a heavy bearer, often requires thinning of fruit. Fruit, large, white, with blushes of red, does not color well in shade. A good shipper and keeper. Flesh white, freestone, of excellent quality. A good seller wherever fruit is known. Fills in nicely between Hiley and Elbert. Average ripening date, July 18.

CAPTAIN EDE—A medium vigorous tree, medium productive; fruit medium size, yellow with a tinge of red; flesh firm, of good quality. Not recommended because of irregular bearing. Average ripening date, July 11.

CHAMPION—A vigorous variety, fairly productive, and a regular producer. Fruit, large white, with a tinge of red in sun. A deep suture which often cracks and starts decay in wet seasons, making it undesirable. Flesh white, freestone, of the highest quality. Average ripening date, July 25.

CHINESE CLING—Trees of low spreading type, medium productive. Fruit very large, an old variety that has been very popular because of its almond-like flavor. Desirable only for home use. Average ripening date, July 20.

ELBERTA CLING—A medium upright growing tree, fairly productive. Fruit medium sized, a tight cling of fair quality. Not desirable because other varieties ripening at the same time are better. Average ripening date, July 20.

EARLY ELBERTA—Tree upright with open top. A vigorous grower with a greenish yellow foliage, a very desirable tree, heavy producer, regular bearer, and a medium early bloomer. Fruit very large, yellow, heavily splashed with red. A very showy fruit. Flesh yellow, firm, fine grained, tender. A mild subacid, very good quality. A much better peach than the old Elberta ripening about three days ahead of it. Average ripening date, July 20.

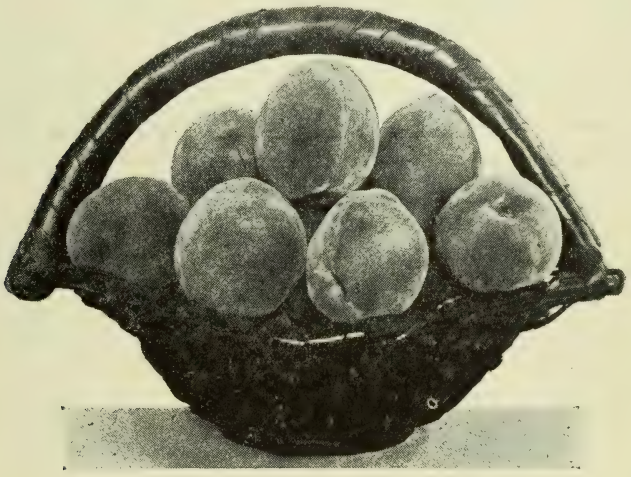


Fig. 7. The Old Elberta.

ELBERTA—Tree vigorous, upright grower, medium productive, some trees producing heavy crops, others very light. Fruit large, yellow, splashed with red, very showy. Skin medium thick and tough. A good shipper. Fair quality. Not as desirable as the Early Elberta. Average ripening date, July 25.

ENGLE MAMMOTH—An upright grower, very productive. Fruit medium sized, yellow, firm, of good quality. A poor seller because other varieties ripening at the same time are far superior. Average ripening date, July 18.

J. H. HALE—A low spreading type of tree, productive when young, a poor producer when old. All trees have a tendency to set many small fruit which never develop. Fruit very large, yellow splashed with red; yellow fleshed, freestone, of good quality, and a good shipper. Not recommended because of some of the tree's habits, and its extreme susceptibility to brown rot. Average ripening date, July 25.

ILLINOIS—A medium slow grower, fairly productive. Medium sized, white fleshed fruit of good quality. Not recommended because other varieties ripening at same time are much better. Average ripening date, July 16.

SEA EAGLE—An upright grower, fair producer, drops its fruit badly in dry weather. Not recommended. Average ripening date, July 14.

TIPPECANOE—A poor grower, poor producer. Fruit large, yellow, of good quality. Not recommended. Average ripening date, July 16.

PEACHES FOR AUGUST

LATE ELBERTA—A medium vigorous grower of upright habit, a good producer, sheds fruit badly in dry weather. Quality about the same as Elberta. Average ripening date, August 1. Recommended for succession of fruit.

AUGBERT—A vigorous, upright grower, very productive, has a tendency to drop some fruit in dry weather. Fruit large, bright yellow, with blushes of red in sun. Flesh, firm, tender, subacid, of good quality. A good shipper. Highly recommended as a late peach. Average ripening date, August 15.

BLOOD CLING—An upright grower, heavy producer, an Indian type. Color a mottled red flesh, firm, clingstone, and red to the pit. Much prized in the South for sweet pickle. Of good quality for eating out of hand. Average ripening date August 10.

INDIAN BLOOD CLING—A vigorous grower of upright habit, which ripens with Blood Cling. Fruit of the same character, except larger. Average ripening date, August 10

SALWAY—A medium growing tree, fairly productive. Fruit medium to large, yellow, of excellent quality. Does well in normal seasons, but drops its fruit badly in dry seasons. Average ripening date, August 15.

ESTELLA—A medium vigorous grower of spreading habit, a regular and heavy producer. Fruit medium to large, yellow, heavily splashed with red on sun side. Flesh firm, subacid, of good quality. A desirable late variety. Produces good crops in normal seasons. Average ripening date, August 25.

SEVEN YEARS' AVERAGE OF THE DATE OF FULL BLOOM AND TIME OF RIPENING OF THE DIFFERENT VARIETIES

		Average date of full bloom	Average ripening date
1.	Mayflower	3-24	5-25
2.	Sneed	3-21	5-28
3.	Alabama	3-19	6-10
4.	Early Rose	3-16	6-20
5.	June Elberta	3-20	6-24
6.	Greensboro	3-19	6-24
7.	Arp Beauty	3-24	6-28
8.	Crawford Early	3-18	7-1
9.	Priceless	3-18	7-4
10.	Mamie Ross	3-17	7-7
11.	Carman	3-22	7-8
12.	Captain Ede	3-19	7-11
13.	Crawford Late	3-19	7-12
14.	Hiley	3-14	7-12
15.	Sea Eagle	3-15	7-14
16.	Gladys	3-13	7-16
17.	Illinois	3-19	7-16
18.	Lucy Bunn	3-18	7-16
19.	Tippecanoe	3-17	7-16
20.	Engle Mammoth	3-17	7-18
21.	Georgia Belle	3-16	7-18
22.	Chinese Cling	3-22	7-20
23.	Elberta Cling	3-19	7-20
24.	Early Elberta	3-14	7-20
25.	Champion	3-20	7-25
26.	Elberta	3-15	7-25
27.	J. H. Hale	3-19	7-25
28.	Late Elberta	3-14	8-1
29.	Big Indian Blood	3-20	8-10
30.	Blood Cling	3-22	8-10
31.	Augbert	3-16	8-15
32.	Salway	3-18	8-15
33.	Estella	3-17	8-25

In checking over the different varieties a difference of ten days is found in the average blooming dates of some varieties of peaches. Note Mayflower and Hiley. There is an average difference of ten days in the time the petals fall from these two varieties, which makes spraying for curculio difficult. The only solution is to spray Hiley, Elberta, and other early-blooming kinds when ready, and the late-blooming kinds later, or at the second spraying, which is ten days later. The average blooming dates are given in order that those blooming together may be planted together, which would insure better pollination and make spraying easier.

Many good varieties ripen the middle of July. There are a few good varieties that ripen early, and some that will stand the heat and ripen good crops of fruit in late Summer. The tendency of the home orchardist is to plant many varieties. Such a practice frequently results in an over-supply in the mid-season, and no fruit early or late in the season. Each peach listed in this test has some merit, but some other variety ripening near the same date may have many qualities that are better.

In a selection of twelve varieties from the thirty-three tested, each variety is picked because it is best for its season.

Mayflower is not a good peach but it satisfies to a degree the longing for ripe fruit in early Summer. Alabama, meaning "Here we rest," signifies in the truest sense a place to rest when the fruit of this variety is ripe. The Alabama is an early peach of good quality, a productive tree which ripens at a season when a good peach is needed. The Early Rose is desirable for home and market, and is the best of its season. The only fault of this variety is its size. Unless thinned, the fruit is too small. The Arp Beauty is picked because of its quality, and its profitableness in local markets. It is superior to any peach ripening at its season. The Priceless resembles the Carman, its male parent, but ripens four days earlier, and is superior in quality and productiveness. The Priceless ripens its fruit in a shorter period, usually one week, while the Carman ripens over a period of two weeks. Carman frequently overlaps Hiley. A fault of the Carman is to bear light crops on some of its trees. Hiley may be said to be the climax of

good peaches. It is of the best quality, very productive, and with a tendency to overload, of high color, and is the best market peach. Gladys has not been widely tried, but has done so well here that it naturally falls in the twelve best varieties. It is an early yellow peach of quality, productiveness, and salability on local markets. The Belle of Georgia finds a place on every planting list because of its peachy flavor and quality, and because it is so dependable. The Early Elberta has done so well in the variety test that it should replace the old Elberta in every planting list. The fruit is of better quality, more showy, and the tree is more regular in its production. The Indian Blood Cling is very satisfactory, being especially good for pickling, preserving and eating out of hand. The Indian peach is hard to secure because no trees are sold for commercial plantings. The Augbert, a late peach, should be in every planting. It is very hardy, resisting both heat and cold. In the Fall of 1929 the fruit buds of most of the varieties were killed by the first Fall freeze, and few fruits were produced in 1930. The Augbert, apparently, was not damaged, and set a good crop of fruit. The Augbert has borne regularly, splendid crops of fruit. The Estella peach is desirable because of its lateness. It matures its fruit late in August, and is of excellent quality.

There are many varieties of peaches not listed that have desirable qualities. The fewest number of varieties that will give a continuous supply of fruit is best. Keeping in mind a continuous supply of fruit, resistance to disease and drouth, economical production, the following list may be named:

Variety	Average date of full bloom	Average date of ripening
Mayflower	3-24	5-25
Alabama	3-19	6-10
Early Rose	3-16	6-20
Arp Beauty	3-24	6-28
Priceless	3-18	7-4
Hiley	3-14	7-12
Gladys	3-13	7-16
Belle of Georgia	3-16	7-18
Early Elberta	3-14	7-20
Big Indian Blood	3-20	8-10
Augbert	3-16	8-15
Estella	3-17	8-25

SUMMARY

There is great variation in the blooming of peaches. The last to bloom is usually the first to ripen.

The greatest number of varieties ripen in July.

There are few good varieties that ripen early in season or in late Summer.

Many varieties are not profitable.

Plant varieties that serve your purpose best.

BULLETIN No. 285 DECEMBER, 1930

REPORT

OF THE

SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION

By

J. C. ROBERT, W. W. WELBORNE AND
J. L. COOLEY, JR.

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. COLLEGE, MISSISSIPPI

W. R. PERKINS, *Director*

ANNUAL REPORT OF THE SOUTH MISSISSIPPI EXPERIMENT STATION FOR 1930

By

J. C. Robert, W. W. Welborne and J. L. Cooley, Jr.

During the present year the following changes in Station Staff were made: September 1st, Mr. W. R. Perkins, Assistant Director in charge, was made director of Experiment Stations with headquarters at the A. & M. College, and was succeeded by Dr. J. C. Robert. Mr. W. S. Anderson, Horticulturist, was granted a leave of absence for pursuing graduate work and Mr. J. L. Cooley, Jr., has assisted in this work since May 1st. Mr. W. W. Welborne has devoted practically all of his time to work with field crops and fertilizers.

Our work for this year has included varieties of field, forage, and horticultural crops; experiments with varying amounts of fertilizers and different combinations of the same, with view of determining that best adapted to our soil conditions; the application of lime for correcting the acid condition of soil; and plant pathology investigation. The plant disease investigations and observations included cotton wilt, cotton rust, tomato wilt, brown rot of peaches, black rot of grapes, bacterial blight of beans, leaf spot of strawberries, black rot of sweet potatoes, and mosaic disease of sugar cane. These extensive investigations required the planting, working and harvesting of approximately 1,400 plots. The Plant Pathology work has been under supervision of Dr. L. E. Miles.

During the growing period of the crops herewith reported, we had a most unfavorable season. The drought in this section was almost unprecedented. At the Station this year in June we had .75 of an inch rainfall, in July, 2.61, and in August, 7.22 inches. The farms in this section of the State suffered in like manner, which fact has largely been responsible for the general crop shortage that has been experienced. Our rainfall for the year to date, November 25th, has been only 45.71 inches, while in 1929 for the twelve months it was 70 inches, and in 1928, 83 inches. In June, 1928, we had 19.43 inches rainfall, in July, 10.46, and in August, 7.28. We made a poor corn crop this year, but a good soybean hay crop to supplement it, and indications point to an oat crop that will assist us materially. We have ginned 31 bales of cotton from approximately 40 acres, which for the past unfavorable season we consider a fair yield.

It should be borne in mind that all of this work was conducted with one specific object in view—the determination of the best varieties of plants, fertilizers, and cultural methods suited to our soil and climatic conditions. This work was never intended, nor was the Experiment Station ever designed, to make money. The Station is an experimental farm laboratory, and our efforts have been to work out important problems of economic importance to the farmers. The results of this year's work are outlined in the following pages. Farmers of this section of the State who have not done so should visit their Station, learn from observation and detailed explanation

what has been done, and allow us to assist them in working out their farm problems. The farmers of Mississippi, who constitute about 87 percent of the population, have as great a need and as clear a title to assistance in practical, workable, information, as has any other class of citizens.

WINTER COVER CROPS

Practically all of the Station land cultivated this year has been planted to oats, or a combination of oats and Hairy Vetch, or oats and Austrian peas. These crops not only protect the soil from washing, and secure plant food made available during winter in our mild climate—which plant food would otherwise be leached out of the soil—but, when turned under in the spring improve materially the physical condition of the soil and make food for bacterial activity. The nitrogen gathering bacteria growing on decaying vegetation are thought to add considerably to the nitrogen content of the soil.

DEMONSTRATION PLOTS

It has been said that "seeing is believing." Educators tell us that 87 percent of our information comes to us through the eye. We have reserved a small plot of land near the Station office for the purpose of making a comparison of the field and forage crops that will grow best under our conditions during the year. In this plot we place, too, available recently imported plants secured from the Bureau of Plant Industry at Washington, D. C. We have found our visitors much interested in the comparative growth of these crops. Alternate rows of these plots have been limed, and in this manner we secure practical information of interest to our visitors. It is not expected that all of the plants grown on these demonstration plots will be of value to the farmers, but those plants of greatest value are easily detected. We find also that some crops that have heretofore received little consideration in this section, appear to be of considerable agricultural promise. All of these are planted at the same time and cultivated in like manner. In this way we secure a record of each plant.

The following plants constitute a partial list of our fall Demonstration Plot Planting: Italian Rye Grass, Canadian Field Peas, Imported Italian Rye Grass, Crimson Clover, Abruzzi Rye, Red Clover, Tall Oat Grass, Meadow Fescue Grass, Austrian Peas, Wheat, Melilotus, Oats, English Rye Grass, Carpet Grass, Bur Clover, Red Top Grass, White Clover, Southern Winter Barley, Alfalfa, Monantha Vetch, Pearl Vetch, Kentucky Blue Grass, Black Medic, Orchard Grass, Alsike Clover, Queensland Hemp, Dwarf Essex Rape, Common Lespedeza, and Hairy Vetch.

CORN AND BILOXI SOY BEANS

Unfortunately, this Station is having to rent 112 acres in order to secure sufficient land for experimental purposes. On the 112 acres of land rented, we have approximately 28 acres that are suitable for experimental work. On the remainder of the cultivated land, which is approximately 40 acres, we planted corn and soy beans. In the preparation of this land, the rows were laid off approximately 4½ feet apart. In February this land was bedded, and about the first of March, fertilizer was applied in the water furrow at the rate of 400 pounds per acre of a 4-8-4 fertilizer. This land was listed and, about the middle of March, corn and soy beans were planted.

In the planting of the soy beans and corn, we used a duplex planter. The corn was planted three feet apart, with a hill of soy beans between each hill of corn. About the middle of May, twenty acres of corn were side dressed with approximately 100 pounds per acre of various sources of nitrogen. Due to an exceptionally dry season, the corn and soy beans were cut short. The soy bean crop cut the yield of the corn approximately 20 percent, but the value of the soy beans as a soil builder more than repaid the shortage of the corn crop. If we take into consideration the damage that the drought did to the corn crop and also the damage that the soy beans did, we consider the yield was fairly good. After harvesting the corn we cut for hay about half of the soy bean crop. We harvested enough soy beans for planting for another year.

FERTILIZER ANALYSIS TEST WITH COTTON

The purpose of this work was to show the effect on cotton, in a four-year rotation, with sweet potatoes, devoting two years to the growth of each crop. For the years 1925, 1926 and 1927, corn was grown on this land, and in 1928 and 1929 sweet potatoes. The fertilizer was applied March 27th, and planted to D. & P. L. Station cotton April 21st. Table No. 1 gives the results of this work in detail, each result reported being the average of triplicate tests.

TABLE No. 1—GENERAL FERTILIZER ANALYSIS TEST—COTTON—MOODY FIELD 1930

Analysis	Lbs. Material Applied per Acre	Yield Seed Cotton per Acre	Check Yield	Increase	Value of Increase	Cost of Fert.	Net Gain
Check		868					
4-8-8	600	1120	845	275	9.62	8.96	.66
4-8-6	600	1060	822	238	8.33	8.38	—.05
4-8-4	600	974	799	175	6.12	7.81	—1.69
Check		776					
4-8-2	600	1238	692	546	19.11	7.23	11.88
4-8-0	600	910	608	302	10.57	6.66	3.91
8-8-4	600	1058	524	534	18.69	11.81	6.88
Check		440					
6-8-4	600	908	489	419	14.66	9.81	4.85
6-4-4	600	916	538	378	13.23	7.15	6.08
4-4-4	600	902	587	315	11.02	6.48	4.54
Check		636					
4-8-4	1200	784	697	87	3.04	15.62	-12.58
4-8-4	1800	988	759	229	8.01	23.44	-15.43
4-8-4	2400	996	820	176	6.16	31.25	-25.09
Check		882					

FERTILIZER ANALYSIS TEST WITH COTTON

The purpose of this test was to show the fertilizer analysis that will give the most economical return when used under cotton.

For six consecutive years this experiment has been conducted on the same land, and during this period each plot received the same amount of fertilizer application. For the three years, 1925, 1926 and 1927 this fertilizer was applied under corn and the next three years, 1928, 1929 and 1930 under cotton. Two and one-half months drought this year materially reduced the yield we would otherwise have secured. The fertilizer was ap-

plied March 25th, and planted to D. & P. L. Station cotton April 21st. Table No. 2 gives the results of this test, each result reported being the average of triplicate tests.

TABLE No. 2—GENERAL FERTILIZER ANALYSIS TEST—COTTON—MOODY FIELD 1930

Analysis	Lbs. Material Applied per Acre	Yield Seed Cotton per Acre	Check Yield	Increase	Value of Increase	Cost of Fert.	Net Gain	% Wilt Infestation
Check		786						2.8
4-8-8	600	1124	812	312	10.92	8.96	1.96	6.2
4-8-6	600	1170	838	332	11.62	8.38	3.24	6.5
4-8-4	600	1158	865	293	10.25	7.81	2.44	13.4
Check		892						2.0
4-8-2	600	1104	891	213	7.45	7.23	.22	5.7
4-8-0	600	996	889	107	3.74	6.66	-2.92	20.2
8-8-4	600	1104	887	217	7.59	11.81	-4.22	13.0
Check		886						3.5
6-8-4	600	1046	908	138	4.83	9.81	-4.98	9.4
6-4-4	600	1146	930	216	7.56	7.15	.41	1.5
4-4-4	600	1108	952	156	5.46	6.48	-1.02	1.1
Check		974						.1
4-8-4	1200	1036	983	53	1.85	15.62	-13.77	.5
4-8-4	1800	1248	992	256	8.96	23.44	-14.48	.2
Check		1010						.1
4-8-4	2400	1182	1001	181	6.33	31.25	-24.92	.3

FERTILIZER ANALYSIS TEST WITH CORN

For the years 1925, 1926 and 1927, this fertilizer analysis test was conducted with sweet potatoes, and in 1928, 1929 and 1930 with corn. During the six years' work each plot has received the same amount of fertilizer from the same source. Due to extreme drought this year, our fertilized and unfertilized corn plots show little difference. The fertilizer was applied and corn planted March 25th. Since the results are comparatively the same, we do not give the table of results.

FERTILIZER WORK WITH OATS

The purpose of this experiment is to determine the most encomical amount of fertilizer to use; the factor variation, if any, due to source of nitrogen; and the best time for fertilizer application to obtain the greatest yield per acre.

These tests were begun in 1926, with the exception of the nitrogen source work which was begun in 1928. The number of plots included in this work is 128, each plot receiving its respective fertilizer treatment each year. In harvesting, we cut the oats with a reaper and binder, shocked and threshed them separately.

In the analysis test the fertilizer was applied February 25th, at the rate of 600 pounds per acre. In the check plots we used 6% of nitrogen, or 36 pounds of nitrogen per acre. The largest increase yield over the check plot was obtained when 600 pounds per acre of a 4-6-4 fertilizer was used. Table No. 3 gives the results of this work in detail, each result reported being the average of four replications.

TABLE No. 3—ANALYSIS TEST—OATS—1930

Lbs. Material Applied per Acre	Analysis	Yield in Bu. per Acre	Check Yield	Increase
600	6-0-0	20.3		
600	6-6-0	28.0	21.2	6.8
600	6-6-2	30.0	22.1	7.9
600	6-6-4	30.1	23.1	7.0
600	6-0-0	24.1		
600	6-6-6	30.6	21.5	9.1
600	6-8-4	32.7	19.0	13.7
600	4-6-4	31.6	16.5	15.1
600	6-0-0	14.0		

NITROGEN AND POTASH ANALYSIS TEST

In 1928, this work was begun for determining the most economical amount of nitrogen on this soil to be used for cotton. During 1928 and 1929, the percent of nitrogen was applied as high as 10%, but since we secured lower yield from 10% than 8% nitrogen, we discontinued the use of 10% fertilizer. As given in Table No. 4 the percent of potash was varied from 4% to 8%.

This fertilizer test has been conducted on the same plots for three consecutive years, thirty-four 1/20 acre plots being used which gives 6 replications of each analysis. The basis of the fertilizer used was 800 pounds per acre of an 0-8-4 analysis. To this application was added the varying amounts of nitrogen as outlined in the following table. The source of nitrogen was nitrate of soda and muriate of potash. The fertilizer was applied March 21, 1930, and the cotton planted April 21st, to the D. & P. L. Station variety. Table No. 4 gives the result of this work in detail.

TABLE No. 4—NITROGEN AND POTASH ANALYSIS TEST—COTTON—BOYD SMITH FIELD—1930

Pounds Material Applied per Acre		Pounds Seed Cotton per Acre		
Pounds	Analysis	Plot Yield	Check Yield	Increase
800	0-8-4	798		
800	4-8-4	1050	787	263
800	6-8-4	1095	776	819
800	8-8-4	1143	765	878
800	8-8-8	1124	754	870
800	0-8-4	743		

POTASH ANALYSIS TEST

The purpose of this test was to investigate the use of potash in varying amounts on this type of soil for controlling cotton wilt and rust. For three consecutive years, this work has been conducted on the same land, and during this time each plot has received the same fertilizer treatment. In this work twenty-one 1/20 acre plots were used, with varying analyses. The analysis of potash varied from a 6-8-0, which was used as a check to a 6-8-14. The percentage of nitrogen and superphosphate was constant. These plots were fertilized at the rate of 800 pounds per acre, using the 6-8-0 as the basis.

Fertilizer was applied March 21st, and D. & P. L. Station cotton was planted April 18th. Table No. 5 gives the results of this work in detail, each result reported being the average of triplicate test.

TABLE No. 5—POTASH ANALYSIS TEST—BOYD SMITH FIELD—COTTON
Fertilizer Applied—800 lbs. per Acre

Analysis	Yield per Acre	Check Yield Seed Cotton	Increase	Per cent Wilt Infestation
6-8-0	848			17.1
6-8-4	926	860	66	12.8
6-8-8	908	872	36	7.1
6-8-10	982	884	98	8.7
6-8-12	982	896	86	8.7
6-8-14	966	908	58	13.2
6-8-0	920			27.1

POTASH SOURCES AND ANALYSIS TESTS WITH COTTON

The purpose of this test was to determine the best source of potash for cotton yield; and the effect of potash on cotton wilt and rust.

For three consecutive years this test has been conducted on the same land, and during this time each plot, with the exception of one, has received from different potash sources the same amount of this plant food. In the years 1928 and 1929, trona muriate of potash was used as one of the potash sources, but due to the fact that we did not have trona muriate of potash this year we used muriate of potash in a 4-8-8 analysis instead of a 4-8-4 compound. The basis of the fertilizer used was 800 pounds of a 4-8-0 fertilizer, and with exception of one plot, 32 pounds of potash per acre were applied from each source. This fertilizer was applied March 25th, and D. & P. L. Station cotton was planted April 21st. Table No. 6 gives the results in detail, each result reported being the average of triplicate tests.

TABLE No. 6—POTASH SOURCES AND ANALYSIS TEST—MOODY FIELD—COTTON
Fertilizer Applied—800 lbs. per Acre

Analysis	Source	Yield Per Acre Seed Cotton	Check Yield	Increase	Per Cent Wilt Infestation
4-8-0		962			68.1
4-8-4	Potassium Sulphate	1032	948	84	66.0
4-8-4	Muriate	1010	934	76	57.7
4-8-4	Kainit	1170	920	250	32.6
4-8-4	D. M. S.	1022	906	116	67.0
4-8-8	Muriate	994	892	102	53.1
4-8-0		878			

OLD FERTILIZER TEST WITH COTTON

This fertilizer test has been conducted on the same land for twelve continuous years. In 1924 and 1925 these plots were planted to sweet potatoes and in 1926 to corn. Each plot received the same fertilizer treatment while planted to potatoes and corn as when planted to cotton. The fertilizer was applied on March 20th, and planted to Half and Half cotton April 18th. Table No. 7 gives the results of this work in detail, which is self-explanatory.

TABLE No. 7—OLD FERTILIZER TEST—NEAL FIELD

Nitrate Soda	Super Phosphate	Muriate Potash	Yield per Acre Seed Cotton	Per cent Wilt Infestation
200	400	0	292	84.7
Check			130	77.0
200	400	50	716	85.3
200	400	100	803	32.2
Check			317	33.3
200	400	150	904	39.3

THE EFFECT OF POTASH FERTILIZER ON COTTON WILT

The purpose of this test is to determine the value of potash as a controlling factor in cotton wilt and rust.

Since 1919 this fertilizer work has been conducted on the same land and in 1927 the potash sources test was started on fifty-six 1/12 acre plots. Due to the topography of the land, we had to discontinue this work on 28 plots. Land was obtained in the same field in 1929 to continue the work. A basic mixture of a 6-8-0 fertilizer at the rate of 600 pounds per acre was applied, to which was added potash from various sources. With exception of muriate of potash, all potash fertilizers were used in application of 8%. When percentages of potash were varied, muriate of potash, in proportion of 4% to 12%, was used. In 1928 and 1929, stable manure was applied on all plots at the rate of 8.6 tons per acre. For this year's work no stable manure was applied. The plots were planted to Half and Half cotton April 18th. Table No. 8 gives the results of this work in detail.

TABLE No. 8—SERIES I—EFFECT OF POTASH FERTILIZER ON COTTON WILT NEAL FIELD

Lbs. Material Applied per Acre	Analysis	Source	Yield per Acre of Seed Cotton	Per Cent Wilt Infestation
	Check		720	56.5
600	6-8-0		753	62.2
600	6-8-8	KCL	835	49.8
600	6-8-8	Potassium Sulphate	972	58.6
600	6-8-8	D. M. S.	493	89.6
600	6-8-8	Kainit	943	48.7
600	6-8-4	KCL	857	52.6
600	6-8-10	KCL	893	66.1
600	6-8-12	KCL	810	73.0

TABLE No. 9—EFFECT OF POTASH FERTILIZER ON COTTON WILT—NEAL FIELD

Lbs. Material Applied per Acre	Analysis	Source	Yield per Acre Seed Cotton	Per Cent Wilt Infestation
	Check		220	30.1
600	6-8-0		475	18.7
600	6-8-8	KCL	792	17.4
600	6-8-8	Potassium Sulphate	925	20.3
600	6-8-8	D. M. S.	994	22.0
600	6-8-8	Kainit	1098	6.7
600	6-8-4	KCL	662	25.7
600	6-8-10	KCL	742	4.7
600	6-8-12	KCL	522	18.6

Table No. 9 is a replication of the same fertilizer test that we used in Table No. 8. The only variations between the two tests are that in the latter test no stable manure was used. The fertilizer was applied on March 20th and Half and Half cotton planted April 18th. Table No. 9 gives the result of this work in detail, which is self-explanatory.

Table No. 10 gives the details of another series of plots, which are the same as mentioned in the two above paragraphs, tables 8 and 9. In this test, which has been made on the same land for two continuous years, 28 plots were used. In the preparation of the basic 6-8-0 fertilizer we used nitrate of soda and superphosphate. The fertilizer was applied March 20th, and planted to the Half and Half cotton variety April 18th. We do not show the percent of wilt infestation in the above table as the land was not uniformly infested. The presence of rust showed plainly on the plots that did not receive any potash.

TABLE No. 10—SERIES III—EFFECT OF POTASH FERTILIZER ON COTTON WILT NEAL FIELD

Lbs. Material Applied per Acre	Analysis	Source	Yield per Acre of Seed Cotton
	Check		858
600	6-8-0		1156
600	6-8-8	KCL	1156
600	6-8-8	Potassium Sulphate	1232
600	6-8-8	D. M. S.	1258
600	6-8-8	Kainit	1309
600	6-8-4	KCL	1224
600	6-8-10	KCL	1309
600	6-8-12	KCL	1258

FERTILIZER TEST FOR COTTON WILT

This is the first year the experiment has been conducted on this land. In 1929 the land was fertilized uniformly with 600 pounds per acre of a 4-8-4 analysis, but we do not know its previous fertilizer record. This land is classed as Ruston Fine Sandy Loam. The soil is very badly infested with the cotton wilt parasite, and due to this fact and the exceptionally dry season, the yields are not as high as would have been expected during a normal season and under other average conditions. The fertilizer was applied April 4th, and planted to Half and Half cotton April 21st. Table No. 11 gives the results of this work in detail, each result reported being the average of four replications.

TABLE No. 11—FERTILIZER TEST FOR COTTON WILT—ANDERSON FIELD

Lbs. Material Applied per Acre	Analysis	Yield per Acre	Per Cent Wilt Infestation
800 lb	8-8-0	588	88.9
800 lb	4-8-8	526	82.2
800 lb	8-8-8	662	84.6
800 lb	8-8-12	666	85.7
800 lb	8-8-16	546	87.6
800 lb	4-8-4 + 10 Tons Manure	794	74.8
800 lb	6-8-4	452	83.3

SOIL ANALYSIS TEST—MURIATE OF POTASH—COTTON

This work was designed to determine the deficiency, if any, in potash for this type of soil, which is classed as Ruston Fine Sandy Loam. This is the first year this experiment has been conducted on this land. The test consisted of thirty 1-20 acre plots. Each plot was replicated six times. The fertilizer was applied March 31st, at the rate of 800 pounds per acre, and planted to D. & P. L. Station cotton April 22nd. Table No. 12 gives detailed results of the work. We are unable to give the fertilizer treatment this land received prior to this work.

TABLE No. 12—SOIL ANALYSIS TEST—MURIATE OF POTASH—COTTON ANDERSON FIELD

Lbs. Material Applied per Acre	Analysis	Yield per Acre Seed Cotton
800lb	8-8-4	791
800lb	8-8-8	859
800lb	8-8-10	823
800lb	8-8-12	858
800lb	8-8-14	840

SOIL ANALYSIS TEST—SUPERPHOSPHATE—COTTON

The purpose of this experiment was to determine the best amount of superphosphate per acre to use on our soil (Ruston Fine Sandy Loam) for the largest cotton yield. Since we do not know the history of this land, we are unable to give the fertilizer treatment that the soil has received for the past several years. This work included thirty 1-20 acre plots, each fertilizer being repeated five times. The fertilizer was applied March 31st, and D. & P. L. Station cotton planted April 22nd. Table No. 13 gives the results.

TABLE No. 13—SOIL ANALYSIS TEST—SUPERPHOSPHATE—COTTON—ANDERSON FIELD—1930

Analysis	Pounds Material Applied per Acre	Pounds Seed Cotton per Acre
8-4-8	800	792
8-6-8	800	954
8-8-8	800	901
8-10-8	800	918
8-12-8	800	847
8-14-8	800	747

NITROGEN ANALYSIS AS SIDE APPLICATION

The purpose of this test was to determine the most economical value of nitrogen as a side-dressing. The basis of the fertilizer used was 800 pounds per acre of an 0-8-4 analysis. On the plots that received nitrogen as side dressing, 2 per cent nitrogen was applied before planting. The per cent of nitrogen used as side dressing was 2, 4 and 6 percent, which brought the analysis of nitrogen to 4, 6, and 8 percent. The additional nitrate of soda as side dressing, calculated in pounds per acre, amounted to 106.5, 213 and 320 pounds. The basic fertilizer was applied March 21st, and the additional nitrate of soda as side dressing June 17th. D. & P. L. Station cotton was planted on April 18th. Table No. 14 gives the results of this work.

TABLE No. 14—NITROGEN ANALYSIS AS SIDE DRESSING—COTTON—BOYD SMITH FIELD—1930

Lbs. Material Applied per Acre Before Planting	Analysis	Lbs. Additional Nitrate Soda as Side Dressing	Lbs. Seed Cotton Per Acre	Check Yield	Increase
800	0-8-4		852		
800	2-8-4	106.5	1062	862	200
800	2-8-4	213.0	1058	873	185
800	2-8-4	320.0	1140	884	256
800	2-8-8	320.0	1144	895	149
800	0-8-4		906		

ADDITIONAL TOP DRESSING WITH MURIATE OF POTASH

The object of this work was to determine the economical value of muriate of potash as a side dressing, and also, to see if it has any effect on controlling cotton wilt. This test has been conducted on the same land for three consecutive years, twenty-one 1-20 acre plots having been used. The basis of the fertilizer used uniformly on these plots was at the rate of 800 pounds per acre of a 6-8-4 home mixed fertilizer, composed of nitrate of soda, superphosphate and muriate of potash. The basic mixture of fertilizer was applied March 21st, and the top dressing of potash June 17th. D. &. P. L. Station cotton was planted on April 18th. The results of this test are given in Table No. 15, each result reported being the average of triplicate tests.

TABLE No. 15—POTASH SIDE DRESSING—BOYD SMITH FIELD—COTTON
Fertilizer Applied—800 pounds per Acre

Lbs. Material Applied before Planting	Analysis	Side Dressing per Acre	Yield per Acre Seed Cotton	Check Yield	Increase	Per cent Wilt Infestation
800	6-8-4	Check	952			12.6
800	6-8-4	50	962	951	11	12.6
800	6-8-4	100	922	950	-28	9.5
800	6-8-4	150	1008	948	60	10.1
800	6-8-4	200	944	945	-1	11.2
800	6-8-4	250	1014	944	70	12.0
800	6-8-4	Check	942			15.2

SIDE DRESSING COTTON

The purpose of this work was to determine the value of a commercial fertilizer applied as a side dressing.

This is the first year this test has been conducted on this land, which includes four replications of each fertilizer used as a side dressing. The land was fertilized uniformly with 600 pounds per acre of a 4-8-4 analysis before planting. On June 12th, the two sources of fertilizer were applied at the rate of 350 pounds per acre. Table No. 16 gives the results of this work.

TABLE No. 16—SIDE DRESSING—COTTON—ANDERSON FIELD

Lbs. Material Applied before Planting	Analysis	Lbs. Material Applied per Acre As Side Dressing	Analysis	Yield per Acre Lint Cotton
600	4-8-4	350	9-0-0	772
600	4-8-4		Check	756
600	4-8-4	350	9-0-15	897

HIGH ANALYSIS FERTILIZER TEST—COTTON

The purpose of this experiment is to determine the values of high analysis fertilizer used under cotton on our land, geologically classified as Ruston Fine Sandy Loam. In 1929, we used a 4-8-4 fertilizer applied at the rate of 600 pounds per acre. For the previous years we have no record as to the amount and kind of fertilizer used on this land. This test includes four high analyses and one low analysis fertilizer. The low analysis fertilizer test was used as a check plot. The fertilizer was applied April 10th at the rate of 800 pounds per acre. The variety of cotton planted was the D. & P. L. Station, and was planted April 21st. Table No. 17 gives the result of this work; each result reported was the average of five replications.

TABLE No. 17—HIGH ANALYSIS FERTILIZER TEST—COTTON—ANDERSON FIELD 1930

Analysis	Lbs. Material Applied per Acre	Lbs. Seed Cotton per Acre
15-30-15	800	588
16.5-16.5-21.5	800	635
12-24-12	800	533
16-20-0	800	480
4-8-4	800	552

NITROGEN SOURCE TEST WITH CORN

The object of this experiment has been to determine the effect of nitrogen sources in a six-year rotation of cotton and corn with view of determining the most economical source of nitrogen. This is the third consecutive year this land has been planted in corn in this experiment. This same fertilizer test was conducted with cotton in 1925, 1926 and 1927. There are twenty-five 1-20 acre plots in this test, which gives three replications of each source of nitrogen used. The fertilizer was applied at the rate of 600 pounds per acre of an 0-8-4 fertilizer and the nitrogen plots received in addition 48 pounds each of actual nitrogen per acre from the various sources. This fertilizer was applied on March 25th, and planted on March 26th. Table No. 18 gives the results of this work in detail, which is self-explanatory.

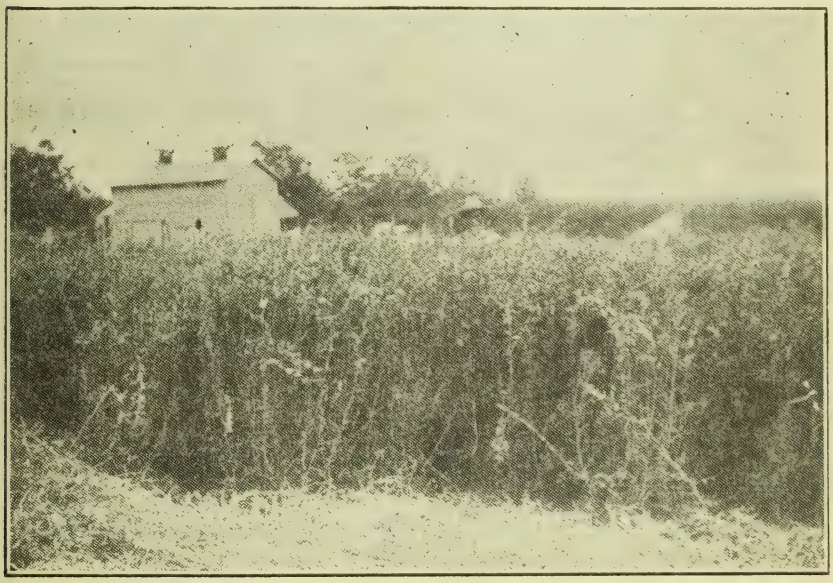
TABLE No. 18—NITROGEN SOURCES—CORN—MOODY FIELD—1930

Analysis	Lbs. Material Applied per Acre	Source of Nitrogen	Bushels Per Acre	Check Yield	Increase
0-8-4	600		9.6		
8-8-4	600	Nitrate Soda	14.0	9.2	4.8
8-8-4	600	Am. Sulphate	14.4	8.8	5.6
8-8-4	600	Cal. Cyanamid	12.3	8.4	3.9
0-8-4	600		8.0		
8-8-4	600	Cal. Nitrate	13.5	8.1	5.4
8-8-4	600	Urea	14.5	8.1	6.4
8-8-4	600	Leunasalpeter	12.6	8.2	4.4
0-8-4	600		8.2		

COTTON FOLLOWING WINTER LEGUMES

In the latter part of September, 1929, approximately one acre and a quarter of land on which cotton had been grown, was planted to Austrian winter peas. The cotton stalks were left standing to support the peas. The peas made a fine growth, averaging four and one-half feet in height. The first of June the peas were cut and threshed for seed. Immediately after the peas were harvested, this land was prepared for cotton. Fertilizer was applied at the rate of 800 pounds per acre of a 6-8-4 analysis. Three varieties of cotton were planted June the 7th. These grew exceptionally fast and necessitated very little cultivation. In August and the first part of September this cotton was dusted for boll weevils and army worms.

Results were obtained from the three varieties, each result reported being the average number pounds of seed cotton per acre; D. & P. L. Station, 987 pounds; Stoneville No. 3, 819 pounds, and Stoneville No. 2, 684 pounds.



Austrian Winter Peas Planted in Cotton Middles the Latter Part of September. Photograph Taken June 2nd, and Followed by Cotton June 7th.

COTTON FOLLOWING IRISH POTATOES

The purpose of this test was to determine the possibility of a profitable yield of cotton on land following Irish potatoes.

Immediately after the harvesting of potatoes, the land was prepared, and planted to cotton June 6th. Fertilizer was not applied to the soil before planting of the cotton, since the Irish potatoes were fertilized highly, 1,500 pounds per acre of a 4-8-4 fertilizer having been used. Very little cultivation was necessary, as the growth was exceptionally rapid. Through

the month of August and a part of September the cotton was dusted for boll weevils and army worms. The variety of cotton planted was D. & P. L. Station. On one-half acre of land we secured 462 pounds seed cotton.

NITROGEN SOURCES TEST—COTTON

The object of this work was to determine the source of nitrogen that would give the most economical returns when used under cotton.

The several sources of nitrogen used in this test were applied at the rate of 600 pounds per acre of a 6-8-4 analysis carrying 36 pounds per acre of nitrogen. This test has been conducted on the same land for three consecutive years, each plot receiving the same amount of nitrogen, but from different sources. The fertilizer was applied March 24th, and planted April 17th. Table No. 19 gives the result of this work in detail, the figures given being the average of triplicate tests in each instance, with the exception of the nitrate of soda, ammonium sulphate and calcium cyanamid, which were replicated four times.

TABLE No. 19—NITROGEN SOURCES TEST—COTTON—BOYD SMITH FIELD—1930

Lbs. Material Applied per Acre	Analysis	Source of Nitrogen	Pounds Seed Cotton per Acre		
			Plot Yield	Check Yield	Increase
600	0-8-4		608		
600	6-8-4	Nitrate Soda	946	662	284
600	6-8-4	Am. Sulphate	735	716	19
600	6-8-4	Cal. Cyanamid	859	770	89
600	0-8-4		825		
600	6-8-4	Cal. Nitrate	870	825.5	44.5
600	6-8-4	Urea	814	825.5	-11.5
600	6-8-4	Cal Urea	848	826.0	22
600	6-8-4	Leunasalpeter	708	826.0	-118
600	0-8-4		826		

ORGANIC NITROGEN SOURCES TEST—COTTON

This work consists of twenty-five 1-20 acre plots, with different sources of organic nitrogen alone and in combination with one-half of the nitrogen from nitrate of soda. The work has been conducted on the same land

TABLE No. 20—ORGANIC NITROGEN SOURCES TEST—COTTON—KENDRICK SMITH FIELD—1930

Material Applied per Acre	Analysis	Source of Nitrogen	Pounds Seed Cotton per Acre		
			Plot Yield	Check Yield	Increase
600lb	0-8-4		741		
600lb	4-8-4	Dried Blood	854	752	102
600lb	4-8-4	Fish Scrap	842	764	78
600lb	4-8-4	Tankage	868	776	92
600lb	0-8-4		788		
600lb	4-8-4	½ Fish Scrap ½ Nit. Soda ½ Tankage	870	799	71
600lb	4-8-4	½ Nit. Soda	912	811	101
600lb	4-8-4	Calcium Nit.	864	822	42
600lb	0-8-4		834		

for the past five years, and during this time each plot has received the same amount of nitrogen each year from the same source. All plots got the equivalent of 600 pounds per acre of a 0-8-4 analysis, and in addition 24 pounds of nitrogen applied from the several sources. The fertilizer was applied April 8th and the seeds of the D. & P. L. Station variety were planted April 18th. Table No. 20 gives the results of this test in detail, each result reported being the average of triplicate tests.

NITROGEN SOURCES TEST WITH COTTON

The purpose of this test is to determine the source of nitrogen that will produce the highest yield of cotton on our type of soil.

In this work we used nine sources of nitrogen, and from each of the nine we applied 64 pounds of nitrogen per acre. The basis of the fertilizer used was at the rate of 800 pounds per acre of an 0-8-8 fertilizer. This is the first year this work has been conducted on this land. Due to the extreme drought this year, the yield was not what we would expect in a normal season. The fertilizer was applied April 4th, and planted to D. & P. L. Station cotton April 21st. Table No. 21 gives results of this work, each result reported being the average of triplicate tests.

TABLE No. 21—NITROGEN SOURCES TEST—COTTON—ANDERSON FIELD—1930

Analysis	Sources	Lbs. Material Applied per Acre	Lbs. Seed Cotton per Acre
4-8-4		800	633
8-8-8	Nitrate Soda	800	492
8-8-8	Calcium Cyanamid	800	534
8-8-8	Sulphate Ammonia	800	482
8-8-8	Arcadian N. Soda	800	574
8-8-8	Urea	800	640
8-8-8	Cal Nitro	800	670
8-8-8	Nitrate Lime	800	530
8-8-8	Cal Urea	800	660
8-8-8	Leunasalpeter	800	584

NITROGEN SOURCES TEST—OATS

This test has been made on the same land for three consecutive years, with each plot receiving its respective fertilizer treatment each year. In this work we used six sources of nitrogen, each being replicated four times. A basic fertilizer of a 0-6-4 analysis was applied at the rate of 600 pounds

TABLE No. 22—NITROGEN SOURCES—OATS—1930

Analysis	Source	Rate Applied per Acre	Yield in Bu. per Acre	Check Yield	Increase
0-6-4		600lb	25.6		
6-6-4	Nitrate Soda	600lb	36.3	23.9	12.4
6-6-4	Nitrate Lime	600lb	37.1	22.3	14.8
6-6-4	Cal-Urea	600lb	34.5	20.8	13.7
0-6-4		600lb	19.3		
6-6-4	Leunasalpeter	600lb	35.7	18.9	16.8
6-6-4	Urea	600lb	35.2	18.6	16.6
6-6-4	Cal-Nitro	600lb	33.8	18.3	15.5
0-6-4		600lb	18.0		

per acre, and 36 pounds of nitrogen per acre from each source were applied. The highest increase in bushels per acre over the yield of the 0-6-4 plot was obtained when Leunasalpeter was used as the nitrogen source. Table No. 22 gives the results of this work in detail, which is self-explanatory.

POTASH SOURCES TEST—COTTON

For three consecutive years this test has been conducted on the same land, and during this time each plot received the same amount of potash, but from different sources. Four sources were used, namely: Muriate of Potash, Sulphate of Potash, Kainit and Sulphate of Potash Magnesia. There are seventeen 1-20 acre plots used in this test. Each of the above sources was replicated three times. These plots were fertilized uniformly with a 6-8-0 analysis at the rate of 800 pounds per acre, and 32 pounds of potash were applied from each source.

The fertilizer was applied March 21st and D. & P. L. Station cotton planted April 18th. Table No. 23 gives the results in detail.

TABLE No. 23—POTASH SOURCES—BOYD SMITH FIELD—COTTON
Fertilizer Applied—800 Pounds per Acre

Analysis	Source	Yield per Acre Seed Cotton	Check Yield	Increase	Percent Wilt Infestation
6-8-0		942			8.1
6-8-4	KCL	1090	975	115	1.2
6-8-4	Potassium Sulphate	1164	1008	156	1.6
6-8-4	Kainit	1198	1041	157	1.7
6-8-4	D. M. S.	1164	1074	90	1.8
6-8-0		1108			9.0

HIGH ANALYSIS vs. LOW ANALYSIS—COTTON

This test includes two low analyses and only one high analysis fertilizer. The three analyses used are the 4-8-4 "Plant Food," 4-8-4 Meridian fertilizer, and 15-30-15 nitrophoska. These were tested on thirty plots, each fertilizer having been repeated ten times. This test was conducted on land that had never been in experimental work before, and due to this fact we are unable to give the fertilizer treatment previous to this year's work. The fertilizers were applied in the proportion that each plot received the same amount of actual plant food. This fertilizer was applied April 8th, and planted to D. & P. L. Station cotton April 24th. Table No. 24 gives the results of this work, which is self-explanatory.

TABLE No. 24—FACTORY LOW vs. FACTORY HIGH—COTTON—ANDERSON FIELD 1930

Analysis	Lbs. Material Applied per Acre	Lbs. Seed Cotton per Acre
4-8-4 (Meridian)	800	635
4-8-4 (Plant Food)	800	739
15-30-15 (Nitrophoska)	213	669

HIGH vs. LOW ANALYSIS FERTILIZERS

The purpose of this test was to secure the comparative value of the high analysis, with that of the low analysis fertilizers. The work was done on twenty 1-20 acre plots, each fertilizer used having been replicated five times. In this comparison the same amount of actual plant food was applied to each plot. In comparing the 4-8-4 analysis at the rate of 600 pounds per acre we used 160 pounds per acre of the 15-30-15 analysis. The 3-9-3 analysis was applied at the rate of 600 pounds per acre in comparison with 200 pounds per acre of the 9-27-9 analysis. All the fertilizers were applied April 4th, and planted to D. & P. L. Station cotton April 18th. The result of this work is given in Table No. 25 in full detail.

TABLE No. 25—FACTORY HIGH vs. LOW ANALYSIS FERTILIZERS—COTTON—KENDRICK SMITH FIELD—1930

Lbs. Material Applied per Acre	Analysis	Pounds Seed Cotton per Acre
600	4-8-4	859
160	15-30-15	847
200	9-27-9	886
600	3-9-3	864

FACTORY vs. HOME-MIXED FERTILIZER—COTTON

The purpose of this test was to compare the value of home-mixed fertilizer with that of the factory-mixed product. In this test we are using only three different fertilizers, namely: home-mixed 4-8-4, Meridian Factory mixed 4-8-4, and 4-8-4 "Plant Food" manufactured at Canton, Mississippi. In the home-mixed fertilizer, we used nitrate of soda, superphosphate and muriate of potash in the proper proportions to furnish the same amount of plant food as was contained in the "Plant Food" and the factory mixed goods. This work is being conducted on twenty-five 1-20 acre plots, making a total of six replications of each fertilizer used. Table No. 26 gives the results of this test in detail.

TABLE No. 26—FACTORY vs. HOME MIXED—COTTON—KENDRICK FIELD—1930

Material Applied per Acre		Analysis	Pounds Seed Cotton per Acre		
Factory Mixed	Home Mixed		Plot Yield	Check Yield	Increase
No Fertilizer			544		
600 (Factory)		4-8-4	869	552	317
	600	4-8-4	953	560	393
600 (Plant Food)		4-8-4	969	568	401
No Fertilizer			577		

FACTORY vs. HOME-MIXED FERTILIZER TEST WITH CORN

The purpose of this test was to determine the comparative economic returns between factory-mixed, and home-mixed fertilizers.

In this work we compared three fertilizers, namely: Meridian Factory mixed 4-8-4; "Plant Food" 4-8-4 manufactured by the factory at Canton; and the home-mixed 4-8-4. In the preparation of the home-mixed 4-8-4,

nitrate of soda, superphosphate and muriate of potash were used to furnish the same amount of plant foods as was supplied in the factory mixed products. This test was conducted on twenty-five 1-20 acre plots and in six replications. The fertilizer was applied April 9th at the rate of 600 pounds per acre and planted to the Cocke's Prolific corn April 23rd. Due to the 2½ months drought in May, June and July, we are not giving the summary of results.

SUPERPHOSPHATE vs. RUHM'S PHOSPHATE

The object of this work was to determine the most economical value between the Ruhm's Phosphate and the Superphosphate. The Ruhm's phosphate contains 32% available phosphorus, whereas the superphosphate contains only 16%.

For three successive years, this test has been made on the same land, using fifteen 1-20 acre plots. A basic mixture of a 4-0-4 fertilizer was applied at the rate of 600 pounds per acre, with superphosphate added to bring the analysis to 8% phosphorus, which was used as a check. The Ruhm's phosphate was added to the 4-0-4 at the rate of 300, 400 and 600 pounds per acre. Fertilizer was applied on March 21st and D. & P. L. Station cotton planted April 17th. Table No. 27 gives the results of this work, the figures given being the averages of triplicate test in each instance.

TABLE No. 27—SUPERPHOSPHATE vs. RHUM'S PHOSPHATE—COTTON—BOYD SMITH FIELD—1930

Pounds Material Applied per Acre				Pounds Seed Cotton per Acre		
Nitrate Soda	Rhum's Phosphate	Super-Phosphate	Muriate Potash	Plot Yield	Check Yield	Increase
160		800	47	944		
160	600		47	922	950	-28
160	400		47	914	957	-43
160	300		47	914	963	-49
160		300	47	970		

TIME APPLICATION WITH OATS

In this test the dates of fertilizer applications were February 12th, February 25th and March 11th. Fertilizers were used at the rate of 600 pounds per acre, and largest increased yield over check plots was obtained

TABLE No. 28—TIME APPLICATION—OATS—1930

Lbs. Material Applied per Acre	Analysis	Time Fertilizer Applied	Av. Yield in Bu. per Acre	Check Yield	Increase
	Check		11.1		
600	6-0-0	Feb. 12th	20.9	11.6	9.3
600	6-0-0	Feb. 25th	20.7	12.1	8.6
600	6-0-0	Mar. 11th	21.1	12.7	8.4
	Check		13.8		
600	6-6-0	Feb. 12th	36.0	13.5	22.5
600	6-6-0	Feb. 25th	31.6	13.7	17.9
600	6-6-0	Mar. 11th	32.8	14.0	18.8
	Check		14.2		

from application of a 6-6-0 fertilizer on February 12th. Table No. 28 gives the results of this test in detail, with each result being the average of four replications.

RATE OF APPLICATION WITH OATS

In the rate of applications, the amount of fertilizer varied, 200, 400 and 600 pounds per acre, having been used with varying analysis as is shown in the following table. The time of application was February 26th. The largest increase in yield over the check plot was 17 bushels per acre, when 600 pounds per acre of a 6-6-0 fertilizer was used. Table No. 29 gives the results of this work in detail, each result reported being the average of the four replications.

TABLE No. 29—RATE OF APPLICATION—OATS—1930

Analysis	Lbs. Fertilizer per Acre	Yield Bushels per Acre	Check Yield	Increase
Check		13.4		
6-0-0	200	23.4	14.7	8.7
6-0-0	400	24.9	16.0	8.9
6-0-0	600	27.0	17.3	9.7
Check		18.6		
6-6-0	200	26.6	19.1	7.5
6-6-0	400	32.7	19.6	13.1
6-6-0	600	37.0	20.0	17.0
Check		20.5		

VARIETIES OF CORN

The object of this work was to determine over a period of years, the variety of corn that is most productive under our soil and climatic conditions. This test consisted of twenty different varieties, each planted in single row plots and replicated eleven times. The fertilizer was applied

TABLE No. 30—VARIETY OF CORN—BOYD SMITH FIELD—1930

Variety	Bushels per Acre	Rank
Mosby Station	9	14
Mosby Delta	8.8	15
Mosby D. & P. L.	8.6	16
Mosby Suttle	9.6	13
Mosby Cork	6.6	19
Mosby Calhoun No. 1 (Woodruff Type)	8.5	17
Mosby Calhoun No. 2 (Station Type)	6.5	20
Cocke's Prolific	10.0	12
Hastings	10.0	11
Jellicorse	10.3	10
College 47	11.2	9
Laguna	11.9	8
Mexican June	20.3	1
Paymaster	14.3	4
Yellow Dent, Ferguson	13.3	6
College Y 4	12.5	7
Golden Dent, R-H	16.6	3
College G 4	14.1	5
Jarvis	17.5	2
Creole	8.3	18

in the drill March 28th at the rate of 400 pounds per acre of a 4-8-4 analysis. All varieties were planted April 10th. Due to the extremely dry summer, these varieties did not produce more than one-third of a normal crop. Table No. 30 gives the results in detail.

MAIN VARIETY TEST—COTTON

The purpose of this test was to determine the variety of cotton best adapted to this type of soil and climate which will produce the maximum amount of best quality staple.

The number of varieties tested this year was 22, each being repeated 12 times. In this work, we used Cleveland 54 as a check, as given in Table No. 31. These checks, distributed throughout the test, ranked about equal in value, and were used to determine the uniformity of the soil. The land was fertilized on March 31st, at the rate of 800 pounds per acre of a 6-8-4 fertilizer, and planted April 23. Table No. 31 gives the results of this test in detail.

TABLE No. 31—MAIN VARIETY—COTTON—ANDERSON FIELD—1930

Variety	Lbs. Seed Cotton per Acre	Lint	Percentage Lint	Length	Cents Per Lb.	Dollars Per Acre	Rank In Value
D. & P. L. 10	1039	383.3	36.9	29/32	9.70	44.39	1
Stoneville 2	1042	364.7	35.0	15/16	9.85	43.57	2
Missdel 2	944	316.2	33.5	31/32	10.20	39.16	3
Roldo Rowden	932	330.0	35.4	29/32	9.70	38.63	4
D. & P. L. 4-8	874	327.7	37.5	29/32	9.70	37.80	5
Express 41077	871	292.6	33.6	1	10.55	37.23	6
Stoneville 3	811	309.0	38.1	29/32	9.70	35.49	7
D. & P. L. 6	806	289.3	35.9	31/32	10.20	35.19	8
Missdel 1	814	279.2	34.3	1	10.55	35.34	9
Cleveland 884	841	300.2	35.7	29/32	9.70	35.07	10
Acala 37	853	282.3	33.1	15/16	9.85	34.09	11
Lone Star 561	810	285.9	35.3	29/32	9.70	33.50	12
Half & Half	784	345.7	44.1	11/16	8.00	32.48	13
Express 17	766	252.0	32.9	31/32	10.20	31.35	14
Miller 8286	776	257.6	33.2	15/16	9.85	31.07	15
Cleveland Piedmont	913	294.0	32.2	25/32	8.20	30.92	16
Cleveland 54	825	289.0	35.0	27/32	8.45	30.32	17
Cleveland 54	826	294.8	35.7	13/16	8.30	30.31	18
Cleveland 54	812	289.0	35.6	27/32	8.45	30.17	19
Miller 589	697	251.6	36.1	15/16	9.85	29.68	20
Wilson Type	846	279.0	33.0	25/32	8.20	29.12	21
Express Lightning 7	613	204.1	33.3	1	10.55	26.03	22
Stoneville 1	635	217.1	34.2	15/16	9.85	25.98	23
Deltatype Webber	491	161.5	32.9	1 3/32	11.30	21.87	24

MISCELLANEOUS VARIETIES—COTTON

This test of 25 varieties, other than the 22 varieties mentioned in the main variety test, was conducted on land fertilized uniformly with an application of 600 pounds per acre of a 4-8-4 analysis. Some of the varieties included in this test work were new varieties and others were new strains of varieties. Each was planted in single row plots and repeated eight times. The fertilizer was applied March 31st, and cotton planted April 23rd. Table No. 32 gives the results of this work, which is self-explanatory.

TABLE No. 32—MISCELLANEOUS VARIETY—COTTON—ANDERSON FIELD—1930

Variety	Lbs. Seed Cotton per Acre	Lint	Percentage Lint	Length	Cents Per Lb.	Dollars Per Acre	Rank in Value
Stoneville 3	858	323.4	37.7	15/16	9.85	37.73	1
Delfos 531	762	263.6	34.6	1 1/16	11.10	34.74	2
D. & P. L. 4-8	768	291.0	37.9	15/16	9.85	33.91	3
D. & P. L. Sta.	709	292.8	41.3	29/32	9.70	32.98	4
Miller 656	775	282.1	36.4	29/32	9.70	32.78	5
Miller 610	783	275.6	35.2	29/32	9.70	32.33	6
Lone Star 562	703	265.7	37.8	15/16	9.85	30.98	7
Stoneville 2	712	252.7	35.5	31/32	10.20	30.83	8
Half & Half (Summerour)	720	316.0	43.9	23/32	8.10	30.04	9
Cleveland 54	742	253.7	34.2	29/32	9.70	29.98	10
Miller 5111	727	254.4	35.0	29/32	9.70	29.88	11
Stoneville 4	714	250.6	35.1	29/32	9.70	29.41	12
Acala 37	681	228.1	33.5	31/32	10.20	28.25	13
Miller 589	676	241.3	35.7	29/32	9.70	28.49	14
Half & Half (Mahon)	693	288.9	41.7	23/32	8.10	27.85	15
Delfos 6112	621	208.6	33.6	1 1/32	11.10	27.69	16
Lone Star 566	618	224.3	36.3	31/32	10.20	27.21	17
Miller 5115	660	228.3	34.6	29/32	9.70	26.90	18
Delfos 463	600	211.2	35.2	1	10.55	26.56	19
Acala A. & M.	576	216.0	37.5	31/32	10.20	25.99	20
Miller 682	580	208.8	36.0	29/32	9.70	24.33	21
Lone Star 561	562	202.8	36.1	29/32	9.70	23.62	22
Miller 613	529	187.7	35.5	15/16	9.85	22.24	23
Red Leaf	490	188.1	38.4	13/16	8.30	18.93	24
Delfos 633	390	129.4	33.2	1 1/32	10.85	16.91	25

WILT RESISTANT VARIETIES OF COTTON

The purpose of this test was to determine the variety of cotton that is the most resistant to wilt, and that will produce the highest yield of cotton.

In this test the varieties were planted in single row plots and in five replications. The test consisted of 16 varieties. All plots were treated with 800 pounds per acre of a 6-8-4 fertilizer, which was applied April 4th,

TABLE No. 33—WILT VARIETIES—ANDERSON FIELD—1930

Variety	Lbs. Seed Cotton per Acre	Lint	Percentage	Length	Cents per Pound	Dollars per Acre	Rank
Cleveland 54	578	198.8	34.4	27/32	8.45	20.97	5
D. & P. L. 4-8	340	130.9	38.5	29/32	9.70	15.00	12
D. & P. L. Sta.	500	208.0	41.6	29/32	9.70	23.39	3
Roldo Rowden	612	210.5	34.4	29/32	9.70	24.84	2
Miller 656	418	152.9	36.6	15/16	9.85	17.98	11
Acala 37	494	167.4	33.9	31/32	10.20	20.66	6
D. & P. L. 10	446	160.5	36.0	15/16	9.85	18.95	9
Deltatype Webber 8	148	44.9	30.4	1 3/32	11.30	6.20	16
Delfos 463	438	150.2	34.3	1 1/32	10.85	19.47	8
Delfos 6112	430	138.8	32.3	1 3/32	11.30	18.88	10
Missdel 2	336	112.9	33.6	1	10.55	14.36	14
Express Lightning	636	215.0	33.8	1 1/32	10.85	27.96	1
Stoneville 4	518	182.3	35.2	15/16	9.85	21.65	4
Lone Star 566	358	126.0	35.2	15/16	9.85	14.96	13
Half & Half	490	205.8	42.0	23/32	8.10	19.80	7
Red Leaf	172	66.0	38.4	27/32	8.45	6.75	15

and planted April 24th. Due to the fact that the land used in this test was badly infested with wilt producing parasite, half of the cotton died before the count of the disease plants could be made. The four most resistant varieties were Lightning Express, Roldo Rowden, D. & P. L. Station and Cleveland 54. Table No. 33 gives the results of this work.

SOY BEAN VARIETY TEST

The purpose of this work was to demonstrate the varieties that are most suitable for our soil, and climate, and for hay production.

On May 24th, seed of 17 varieties of soybeans were planted in three-row plots, each variety being replicated three times. Before the planting, the land was fertilized (April 2nd) with a 4-8-4 fertilizer, at the rate of 400 pounds per acre. Due to the 2½ months drought, these beans did not make an exceptionally large yield. Four of the 17 varieties were cut for hay, and weights were secured and calculated in pounds of cured hay per acre. The four varieties cut for hay yielded as follows: Biloxi, 6,340 pounds; Biloxi Strain No. 40, 5,420 pounds; Biloxi Strain No. 61, 7,220 pounds; and Laredo, 5,108 pounds. The other varieties used in this test were: Delta 6676; Delta 6677; Delta 6679; Delta 5401; Delta 6114; Mammoth 01; Mammoth Yellow; U. S. D. A. H04920-3; George Washington; Virginia Tanlaxi 483, and Tarheel Black.

SUGAR CANE VARIETY TEST

For the past six years there has been conducted at this Station a variety test on sugar cane, with view of determining varieties most resistant to the mosaic disease; those best suited to our type of soil; and varieties that prove to be the best for sugar and syrup.

Co-operative work with the Division of Sugar Plant Investigation, U. S. Department of Agriculture, was started here in 1927, and has made it possible for us to increase our test to 50 varieties. In the beginning of this work, we had an agreement with the Department that we would not publish any results obtained, nor would we release any variety for propagation for syrup or sugar production until officially notified by that department. For this year, the department has released only two varieties, viz: Cayana, and P. O. J. 213. After these two were banked the remaining 48 were made into syrup. After our 1931 crop is planted next spring, the remaining stalks of the Cayana and P. O. J. 213 will be given as long as they last to farmers upon request, with the understanding that each farmer furnish us a report on his experience with this cane.

WINTER LEGUMES

On six one-ninth acre plots, we planted in the fall of 1929, three winter legumes with oats. The three legumes planted were Austrian Winter Peas, Hairy Vetch, and Pearl Vetch. At maturity, these six plots were cut for hay, cured, and weighed. The yields, calculated in pounds per acre, were as follows: Hairy Vetch and oats, 6,960; Austrian Winter Peas and oats, 7,290; Pearl Vetch and Oats, 7,080. These plots were fertilized about the first of March with 200 pounds of Nitrate of Soda per acre. The severe cold weather in January damaged the Austrian Winter peas and Pearl Vetch more than it did the Hairy Vetch.

CO-OPERATIVE NITROGEN AND POTASH ANALYSIS TEST—COTTON

The purpose of these co-operative fertilizer tests are to obtain results of the different types of soils, and also to demonstrate to our farmers the benefit of applying the right amount of fertilizer to their soil in order to receive the most economical returns.

For the past several years, co-operative fertilizer tests have been conducted in two or more counties in South Mississippi. The fertilizer experimental tests made previous to this year's work have been general fertilizer analysis tests, and nitrogen sources tests. The co-operative fertilizer test for this year includes nitrogen and potash analysis test.

Our work this year was conducted in four counties on seven farms. These counties are, Harrison, Stone, Forrest, and Jones. In Harrison county this test was conducted in co-operation with County Agent Vernon Pace, and on the farm of A. S. Anderson. In Stone county, three tests were conducted in co-operation with J. J. Taylor, Secretary Chamber of Commerce, and on the farms of G. W. Hughes, O. E Hiardson, and C. P. Barker, Smith-Hughes teach of the Holmes Consolidated School. In Forrest county two tests were conducted in co-operation with F. O. Cork and W. C. Bayliss. In Jones county this test was conducted in co-operation with M. M. Wheeler, Smith-Hughes teacher of the Shady Grove Consolidated School, and E. N. Lee.

Due to an exceptionally dry season, Mr. O. E. Hiardson failed to get a good stand of cotton, therefore we do not have any results on this test. Mr. W. C. Bayliss reported that he planted his cotton the third time and did not get half a stand, which land he planted in corn at a later date. Tables No. 34, 35, 36, 37, and 38 give the results in detail, each result reported being the average of triplicate tests.

TABLE No. 34—COOPERATIVE NITROGEN AND POTASH ANALYSIS TEST—COTTON
A. S. ANDERSON, BILOXI, MISS.

Lbs. Material Applied per Acre	Analysis	Yield in Pounds Seed Cotton per Acre	Increase Over 0-8-4
800	0-8-4	982	
800	4-8-4	1454	472
800	6-8-4	1649	667
800	8-8-4	1992	1010
800	8-8-8	2486	1504

TABLE No. 35—COOPERATIVE NITROGEN AND POTASH ANALYSIS TEST—COTTON
G. W. HUGHES, WIGGINS, MISS.

Lbs. Material Applied per Acre	Analysis	Yield in Pounds Seed Cotton per Acre	Increase Over 0-8-4
800	0-8-4	987	
800	4-8-4	1267	280
800	6-8-4	1224	237
800	8-8-4	1532	545
800	8-8-8	1650	663

TABLE No. 36—COOPERATIVE NITROGEN AND POTASH ANALYSIS TEST C. P. BARKER, WIGGINS, MISS.

Lbs. Material Applied per Acre	Analysis	Yield per Acre Seed Cotton	Increase Over 0-8-4
800	0-8-4	1040	
800	4-8-4	1256	216
800	6-8-4	1276	236
800	8-8-4	1278	238
800	8-8-8	1302	262

TABLE No. 37—COOPERATIVE NITROGEN AND POTASH ANALYSIS TEST E. N. LEE, SOSO, MISSISSIPPI

Lbs. Material Applied per Acre	Analysis	Yield per Acre Seed Cotton	Increase Over 0-8-4
800	0-8-4	1424	
800	4-8-4	1604	180
800	6-8-4	1842	418
800	8-8-4	1838	414
800	8-8-8	1872	448

TABLE No. 38—COOPERATIVE NITROGEN AND POTASH ANALYSIS TEST F. O. CORK, HATTIESBURGH, MISSISSIPPI (ROUTE)

Lbs. Material Applied per Acre	Analysis	Yield per Acre Seed Cotton	Increase Over 0-8-4
800	0-8-4	600	
800	4-8-4	892	292
800	6-8-4	962	362
800	8-8-4	982	382
800	8-8-8	990	390

Note: This was the first year this land had been placed in cultivation.

REPORT OF HORTICULTURAL WORK AT SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION—1930

By James L. Cooley, Jr., Acting Horticulturist

Much credit for the success of this year's work is due Mr. W. S. Anderson, who is away on a year's leave of absence doing graduate work. In the studying of results of this work, it should be borne in mind that all crops were produced during 2½ months drought, consequently, low and, in many cases, very unsatisfactory yields resulted. This is the first extremely dry period since the year 1899 and should not discourage fruit and vegetable growers.

The comparatively fertile, loose, and sandy soil and mild climate of South Mississippi section gives our Station a wide range of horticultural problems, offering ideal conditions for the production of many fruit and truck crops, and ornamental plants.

All check plot yields and increased yields are obtained according to the standard adopted by the American Society of Agronomy as reported in Volume One, No. 1 of the Journal. The column marked check yield was obtained by assuming that there is a gradual increase or decrease in the fertility of the soil from one plot to another.

The result of our work is evidenced by increased interest, and large plantings by many farmers of this section of such crops as form the basis of this report, which is outlined under the following heads:

PLANT SELECTION WORK

BLUEBERRIES. All plants bore abundantly. The wild strains introduced from the woods of southern Florida appear to be the most prolific. Plants of the improved types introduced from southern Florida and New Jersey produced a good crop of fruit. These berries were exceptionally large and of good quality. Further testing of these is necessary to determine their economic value under our soil and climatic conditions.

SWEET POTATOES. There has been much complaint in this section of a lack of uniformity in type and color of the Porto Rico sweet potato. The work begun in 1929 to improve the uniformity was continued this year. It was necessary to select seed potatoes of uniform type, and to cut and examine each carefully for color variations. The selection is for convenience called "Selected Porto Rico" and was compared in a test with eleven other varieties for productiveness. The potatoes produced by this selection were very uniform in type and color this year, but as to whether or not the variations will again show up in our selection remains to be determined by further trials. The results also indicate that this selection is very productive, having produced the second largest total amount of potatoes per acre of the twelve varieties tested.

IRISH POTATOES. The selection of seed from fifty-one sources for productiveness and resistance to mosaic and leaf roll diseases was con-

ducted in co-operation with Dr. L. E. Miles of the Plant Pathology Department of the A. & M. College, A. & M. College, Mississippi. The selections tested were certified seeds of triumph and cobbler varieties secured from the following states: Mississippi, Nebraska, Wyoming, Kansas, Wisconsin, South Dakota, North Dakota, and Montana.

Certain seed strains tested produced much larger yields and were much more resistant to the leaf roll and Mosaic diseases than others. These results indicate the great importance of planting seeds of the most desirable type. Detailed results of this work may be obtained by request from the State Plant Board, A. & M. College, Mississippi.

VARIETY EXPERIMENTS

GRAPES. The test of 28 varieties of bunch and scuppernong grapes has been continued. Grapes are an important crop for home consumption in south Mississippi and should be of great commercial importance. The one-acre test of scuppernong varieties, begun in 1929, has grown satisfactorily and has been well trellised this fall. The results indicate that the Muench and Hebermont varieties of bunch grapes are the best adapted for this section. Other varieties producing satisfactory yields are Munson, Concord, Delaware, Salem and Lucile. The James, Thomas and Flowers varieties of scuppernong produce well in this section. The grapes of the Flowers variety have very thick hulls and are not to be recommended as highly as the other two varieties named.

Excellent varieties of bunch grapes are to be top grafted on the roots of many other varieties this winter in an attempt to find some combination of stock and scion that will produce high yields of good quality in competition with disease and nematode injury in this section.

WATERMELONS. This work was conducted with ten varieties, six of which were standard commercial varieties, and the other four were new and promising for this section. These were planted ten feet apart in rows ten feet wide. Each plot contained two rows in two replications. Forty-four hills of each variety were planted. Each plot received 400 pounds per acre of a 4-8-4 fertilizer before being planted and 200 pounds per acre of nitrate of soda as a side application after the fruit had set

As given in Table No. 39 the Stone Mountain, Wonder and Tom Watson in order named, produced decidedly the largest yields. These varieties

TABLE No. 39—WATERMELON VARIETY TEST—1930

Variety	Yield in No. per Acre	Average Size in Lbs.	Weight of Largest Melon	Rank in Yield
Halbert Honey	1346	13.9	27	4
Tom Watson	1594	14.1	47	3
Kleckley Sweet	1257	15.3	28	5
Augusta Rattlesnake	1247	15.2	32	6
Thurmond Gray	1049	16.2	34	7
Stone Mountain	1693	16.5	28	1
Wonder	1541	17.0	33	2
New Schochler	683	22.3	45	10
Floribama	941	18.6	40	8
Boyd Stewart	832	21.3	37	9

were the earliest and produced melons of good size, averaging 16½, 17 and 14 pounds each, respectively, and of excellent quality. The largest Tom Watson melon produced weighed 47 pounds. The Halbert Honey variety also gave good results.

The other varieties were comparatively late in ripening. The New Schochler, Floribama and Boyd Stewart varieties produced very large melons, with very thick rinds and of poor quality. Detailed results of this test are given in Table No. 39.

TABLE No. 40—SWEET POTATO VARIETY TEST (BEDDED PLANTS)—1930

Variety	Yield in Bushels per Acre			
	Total	No. 1's	No. 2's	Culls
Beattie Porto Rico	257	196	38	23
Nancy Hall	248	191	41	16
194	221	141	48	32
Porto Rico	273	208	48	17
Big Stem Jersey	227	181	32	14
Selected Porto Rico	289	191	48	50
224	330	239	58	33
64377	287	251	18	18
305	239	132	59	48
Creola	275	206	46	23
Red	283	230	42	11
White Dooley	159	103	41	15
Golden Porto Rico	214	145	60	9
Improved Porto Rico (No. 1)	304	195	30	79

TABLE No. 41—SWEET POTATO VARIETY TEST (VINE CUTTING PLANTS)—1930

Variety	Yield in Bushels per Acre			
	Total	No. 1's	No. 2's	Culls
Beattie Porto Rico	202	135	47	20
Nancy Hall	210	185	21	4
194	75	37	17	21
Porto Rico	142	92	39	11
Big Stem Jersey	94	26	38	30
Selected Porto Rico	231	158	62	11
224	141	100	28	13
64377	141	87	43	11
305	184	109	64	11
Creola	216	109	78	28
Red	139	79	49	11
Golden Porto Rico	148	86	53	9
Improved Porto Rico	216	117	47	52
White Dooley	52	17	—	35

SWEET POTATOES. This work was continued during the year with the addition of three new varieties. The variety listed as Improved Porto Rico No. 1 was introduced from North Carolina. These varieties were tested both with bedded plants (slips or draws) and vine cutting as given in Tables No. 40 and No. 41. Each variety was tested in three-row plots and in three replications. Each plot received 300 pounds per acre of a 4-8-4 fertilizer before being planted. The test with bedded plants was planted May 20th and the one with vine cuttings on July 1st. The varieties listed as Numbers 224, 305, 194 and Creola were obtained from the U. S. D. A.

In the test with bedded plants No. 224 and improved Porto Rico No. 1 produced the largest yields, with productions of 330 and 304 bushels per acre, respectively. The variety No. 64377 produced very uniform potatoes and of good average size. The varieties that seemed to crack the most were Selected Porto Rico, Golden Porto Rico and Improved Porto Rico No. 1. Detailed results of this test are given in Table No. 40.

In the test with the vine cuttings the Selected Porto Rico, Improved Porto Rico, Creola and Nancy Hall varieties produced the largest yields. The varieties listed as No. 194 and Big Stem Jersey reproduced too slowly from vine cuttings, as the results indicate many of the potatoes were so small as to be classed as "strings" and thus culled. Detailed results of this test are given in Table No. 41.

MISCELLANEOUS FRUITS. Observations are being continued in the variety test orchard of the behavior of four varieties of Chinese Jujubes, 12 varieties of pears, 2 nectarines, four varieties of persimmons, and one each of pomegranate, Chinese Chinquapin and Engish Walnut. The varieties of sand, or pineapple pears, Jujubes, raspberries and Young berries produced very satisfactory crops of fruit this year.

TABLE No. 42—PEACH VARIETY TEST—1924-1930

Varieties	Average Production in Pounds per Tree							Total	Avg. per Tree, per Year	Rank
	1924	1925	1926	1927	1928	1929	1930			
Early Mamie Ross	116	36	355	Cold Injury—No Fruit	294	405	Cold Injury—No Fruit	1206	241	1
Slappy	75	60.8	112.9		271	109		628.7	126	5
Alton	6	—	220		135	183		544.0	109	6
Hiley	55	90	227		418	217		690.0	138	3
Carmen	—	18	25		50	89		182.0	36	9
Early Rose	75	—	177.8		43	236		531.8	106	7
Mayflower	4	—	13		4	4		25	5	11
Belle of Georgia	116	112	247		179	180		834.0	167	2
Early Elberta	25	5	239.1		79	335		683.1	137	4
Elberta	12	7	189		13	133		354.0	71	8
June Elberta	36	—	30		58	7		131.0	26	10

PEACHES. The trees of this test were planted in the winter of 1920. The varieties began fruiting in 1924. During the years 1927 and 1930, cold weather caused the trees not to set any fruit. The results include an average production per tree for each year as indicated. Detailed characteristics of each variety as to date of ripening of fruit, color of flesh, and character of stone are given in the Annual Report of this Station for the years 1928 and 1929. The four leading varieties in our test plots for the ten-year period were Early Mamie Ross, Belle of Georgia, Hiley and Early Elberta. The following varieties are recommended for home use or local market: Mayflower, June Elberta, Early Mamie Ross, Slappy, Hiley, Georgia Belle and Carmen. Those recommended for commercial plantings are Belle of Georgia, Hiley, Early Rose and Early Mamie Ross. Detailed results of this test are given in Table No. 42.

TABLE No. 43—ROSE VARIETY BLOOMING RECORD—1930

Varieties	Average Number of Blooms per Bush							Total Avg. per Bush
	April	May	June	July	August	Sept.	October	Nov. (1-20)
Wellesley	82	5	6	11	4	7	6	4	75
Wm. Shean	6	5	5	3	0	5	5	3	32
Antoine Rivoire	9	2	3	3	2	5	4	3	31
White Killarney	1	1	1	2	1	0	2	1	9
Etoile De France	8	5	7	1	4	6	3	6	40
White Cochet	6	8	3	0	0	0	6	8	31
Duchess De Brabant	1	18	14	6	3	7	18	5	72
Bridesmaid	10	7	13	10	7	9	11	4	71
Mrs. Chas. Bell	22	13	6	2	1	4	2	3	53
American Beauty	24	5	11	1	0	2	10	6	59
Sov. De. Malmaison	2	6	5	2	1	3	4	9	32
Segond Weber	14	6	2	1	0	0	5	3	31
Columbia	23	4	5	0	0	4	5	3	44
F. W. Dunlop	10	12	1	2	0	5	2	6	38
Mdme. Butterfly	15	3	2	0	1	5	2	5	33
La France	18	7	8	2	1	6	5	6	53
Mrs. B. R. Cant	16	16	8	0	0	4	26	11	81
J. L. Mock	10	7	3	1	1	6	8	8	44
Golden Ophelia	2	12	4	2	3	7	0	0	30
Paul Neyron	22	8	5	6	0	2	5	5	53
Sou. De Claudius P.	0	5	2	1	1	1	1	0	11
Ophelia	7	5	7	1	1	6	5	9	41
Marie Van Houtte	15	26	13	9	7	8	11	12	101
Wm. R. Smith	3	3	3	0	1	0	4	2	16

ROSES. This test of 24 rose varieties was conducted for the purpose of determining the most prolific and those giving the longest period of blooming. The plants were set in the winter of 1929 six feet apart in rows 10 feet wide. The blooms were cut three times each week. The Marie Van Houtte, Mrs. B. R. Cant, Wellesley and Duchess De Brabant varieties were the most prolific, respectively. These varieties also bloomed continuously over a long period of time. Other outstanding varieties are American Beauty, Etoile De France, Columbia, Paul Neyron, La France, Mrs. Chas. Bell and Ophelia. The most blooms were produced in April, May, June and October. On the date of the last records, as given in table of Rose Varieties, many of the bushes were full of buds and new growth, indicating many flowers will be produced throughout the winter. Detailed results of this test are given in Table No. 43.

TABLE No. 44—PECAN VARIETY TEST—1930

Variety	Pounds per Tree Average	No. Nuts per Lb.	Percent Kernel
Moneymaker	39.1	65	44
Wright	12.8	62	38
Pabst	20.0	92	30
Schley	16.7	78	49
Russell	6.4	85	57
Curtis	13.1	89	53
Success	21.5	66	39
Stuart	9.5	42	47
Teche	14.9	72	48

PECANS. The trees in the Pecan Variety Test are 10 years of age. The Moneymaker, Success, Pabst, and Schley varieties produced the largest yields, respectively. The Stuart and Success varieties produced the largest nuts. The Russell, Curtis, Schley, Teche, and Stuart varieties produced the highest per cent of kernel, respectively.

The dry weather this year decreased the size of the nuts, especially of the Schley and Success varieties. The Stuart, Success, Wright, and Schley continued to be our best varieties for commercial plantings. All plantings of the Schley variety, though the nuts are of the best quality, should be limited due to its susceptibility to the scab disease. Detailed results of this test are given in Table No. 44.

CITRUS FRUITS. The demonstration plots consist of varieties of satsumas, grapefruit, oranges, Tangelo, Limequat, Kumquat, sitrangequat, tangerine and lemons. All trees, except citrangequat and one tree each of Owaria satsuma and Foster grapefruit, were killed back to the mounds by freezes in 1929 and 1930 when the temperature went as low as 15 degrees fahrenheit. The injured trees made three to six feet of new growth this spring.

APPLES. Much attention is still being given to apples in an effort to determine which are the best adapted varieties to our soil and climatic conditions and which are the most blight resistant. Thirty varieties are now growing in our plots and only three are producing satisfactory results, namely: Hackworth, Day, and Red Astrachan, respectively, in order of importance.

TABLE No. 45—SWEET POTATO FERTILIZER TEST—1930

Fertilizers Used		Yield in Bushels per Acre			
Lbs. per Acre	Analyses	Total	No. 1's	No. 2's	Culls
None	None	256	188	37	31
600	4-8-4	229	155	48	26
600	4-8-0	275	182	73	20
600	4-8-8	236	132	80	24
600	4-8-12	276	143	80	53
None	None	220	128	78	14
600	4-8-4	264	135	98	31
600	0-8-4	215	141	42	32
600	6-8-4	246	118	70	58
600	8-8-4	302	146	99	57
600	10-8-4	293	110	103	80
160	15-30-15	275	125	71	79
600	4-8-4	238	96	98	44
600	10-8-4	287	150	56	81
1200	4-8-4	338	177	97	64
600	4-8-4	214	104	90	20

SWEET POTATOES. This test consisted of twelve different fertilizer analyses varying in nitrogen and potash. Every fifth plot was treated with a home-mixed 4-8-4 fertilizer to obtain a check on the uniformity of the soil. All applications were applied at the rate of 600 pounds per acre, except in one case where a 1200 pound application was made. All analyses

were tested in three-row plots so that the results could be obtained from the central rows to prevent any irregularities from the different treatments in adjacent plots. The 1200 pound application of the 4-8-4 analysis produced the largest yield per acre. The 8-8-4 analysis produced the largest yield in the regular 600 pound test. The plots receiving no fertilizer produced fair yields, indicating that the soil used for this test was very fertile.

The results indicate that the 600 pound application is more profitable that the 1200 pound application. The fact that the analysis carrying 8% of nitrogen produced the best results indicates that the sandy soils of this section need heavy applications of nitrogenous plant food. Detailed results of this test are given in Table No. 46.

TABLE No. 46—IRISH POTATO FERTILIZER ANALYSIS TEST—1930

Fertilizer Used per Acre	Analyses	Bushels per Acre		
		Plot Yield	Check Yield	Increase
1500 lb	Factory Mixed	4-8-4	96.50	96.50	0.0
1500 lb	Home Mixed	4-8-8	106.25	99.00	7.25
1500 lb	Home Mixed	4-8-6	103.75	101.50	2.25
1500 lb	Home Mixed	4-8-2	102.00	104.00	—2.00
1500 lb	Factory Mixed	4-8-4	106.75	106.75	0.00
1500 lb	Home Mixed	4-8-0	99.25	104.50	—5.25
None		None	67.75	102.25	—34.50
1500 lb	Home Mixed	8-8-4	104.50	100.00	4.50
1500 lb	Factory Mixed	4-8-4	97.75	97.75	0.00
1500 lb	Home Mixed	6-8-4	100.75	99.75	1.00
1500 lb	Home Mixed	4-6-4	86.75	101.75	—15.00
1500 lb	Home Mixed	4-4-4	118.00	103.75	14.25
1500 lb	Factory Mixed	4-8-4	105.75	105.75	0.00
None		None	83.00	104.25	—21.25
1500 lb	Home Mixed	10-8-4	104.00	102.50	1.50
1800 lb	Home Mixed	4-8-4	98.75	100.70	—2.00
1500 lb	Factory Mixed	4-8-4	99.00	99.00	0.00

IRISH POTATOES. This test consists of twelve fertilizer analyses varying in nitrogen, phosphorus and potash. Every fifth plot was fertilized with a factory mixed 4-8-4 fertilizer to serve as checks on the uniformity of the soil. The plots contain three rows each and were replicated four times. All fertilizers were applied at the rate of 1500 pounds per acre. The yields are given in bushels of marketable potatoes per acre. As given in Table No. 46, the 4-4-4 and 4-8-8 analysis produced the largest yields. The results indicate that the analysis carrying 8% of potash increased the yield 12 bushels per acre over the plot receiving the 4-8-0 analysis and 41 bushels per acre more than the plot receiving no fertilizer. High nitrogen analyses appeared not to materially increase the yield over the plots receiving 4% nitrogen. The analysis carrying 4% of phosphorus produced as good yield as those carrying 6% or 8%. The 4-4-4 analysis produced 43 bushels per acre more than the plots receiving no fertilizer. Detailed results of this test are given in Table No. 46.

MISCELLANEOUS DEMONSTRATIONS

TUNG OIL. The tung trees in our demonstration plots are three years of age. Satisfactory growth has been obtained each year. The trees bore six to twelve nuts each this year. Due to the thousands of trees being planted in this section, this Station intends doing extensive fertilizer, variety, and cultural tests this next year in order to have the information for the growers. No such work of this kind has been done in this state.

SUGAR BEETS. Due to the many requests for information concerning the adaptability and productivity (successful production) of the sugar beet in this section, this Station has planted plots comparing the Jumbo Mangle beet and the sugar beet of the Louisiana Experiment Station as to productivity and percentage of sugar. The low cost of the loose, sandy, fertile soil and the mild climate of this South Mississippi section gives great possibilities of producing the sugar beet. The fact as to whether we can produce satisfactory yields of this beet with a high sugar content remains yet to be determined.

NEMATODES. These experiments have been conducted for the past eight years and consist of the effect of sod mulch, straw mulch, clean culture and a combination of sod mulch and clean culture treatments with peaches and figs. The peach trees with the sod mulch treatment are about one-half the normal size of those in the clean culture plots and have produced but very little fruit.

In the fig plots, the trees mulched with straw produced 95% more fruit and 50% more foliage than those in the clean culture plots, or those in the plots alternating sod mulch and clean culture. The fig trees in the alternating sod mulch and clean culture plots were severely winter killed by the cold of the winter of 1929, and in many cases killed back to the ground. It is evident that the cold resistance of the trees in the straw mulched plots is due to the health and vigor of the trees. Whether a portion of this increased health and vigor is due to a lack of nematode injury has not yet been determined.

In addition to the above mentioned horticultural experiments, work was done on cucumber selections and fertilizer tests with tomatoes, strawberries, peaches and snap beans. However, due to the unprecedented dry season our results were unsatisfactory and details of these investigations are not given in this reoprt.

BULLETIN NO. 286 DECEMBER, 1930

REPORT

OF THE

HOLLY SPRINGS BRANCH EXPERIMENT STATION, 1930

By

T. F. MCGEHEE AND OTIS B. CASANOVA

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. COLLEGE, MISSISSIPPI

W. R. PERKINS, *Director*

INTRODUCTION

The experimental work of this station in 1930, except the gathering of the crops, planning and planting of winter cover crops in the fall, was planned and conducted by Mr. C. T. Ames who resigned the first of September. He was assisted by Mr. Otis B. Casanova and Mr. O. K. Morgan in the field work. Mr. Casanova worked up the results of the fertilizer and variety tests.

The work was planned to cover questions of fertilizers, varieties of cotton and corn and soil improvement. The cold wet spring and extreme drouth later made it very difficult to secure and hold a stand of cotton and other crops. This section experienced the worst drouth that we have known in many years. The feed crops on the station have done well considering the unfavorable conditions.

The results of all of the work done on the station this year are not given in this report. The poor stands made some of the results unreliable so they are not considered.

The Station is actively pursuing twenty-four different lines of study and experimentation with crops and soils. Over twelve hundred experimental plots were used this season, five hundred dealing with soils and fertilizers and seven hundred dealing with crops and cultural methods. Practically all this work was conducted for the first season on the new experimental farm, located about three miles north of the old farm. The experimental work as presented in this report consequently represents a study extending over only one or two seasons, and should be valued as such unless otherwise specified. It is our objective and desire to enlarge upon the work now under progress and experimental investigations upon other problems that are of vital concern to the welfare of the agricultural industry.

COTTON VARIETIES

There has been much discussion as to the best variety of cotton for general planting in the hill section of Northwest Mississippi. From all available experimental records, there seems to be no best variety, for in one season one may lead in production as to lint and staple and the following season that same variety may fall much below the average. There are a number of good varieties that maintain an excellent high average regardless of seasonal conditions. Of course, these varieties that maintain a high average yield over a long period of time would be best suited to our farming conditions and worthy of trial.

We do not believe it advisable to use some of the long staple varieties for general hill land planting. Fertile soils are required to produce and maintain long staples better than one and one-eighth inch. The representative soils of this section are not fertile enough to produce and maintain satisfactory long staples.

Cotton shorter than one inch is not in great demand by the consumers and at this season the shorter cotton is suffering a heavy penalty. It seems that the most satisfactory variety for this section to produce, to meet the demand in the future, will be from fifteen-sixteenths inch to one and one-eighth inch. Varieties within this range of staple should be selected and pure seed maintained.

The varieties, as listed in the tables, are arranged according to their rank in money value per acre. The computations were made in accordance with an average price for lint and seed based on several of the leading southern markets. In the average tables, for both hill and valley tests, the value of lint and seed has varied greatly from year to year. Consequently, some of the recent improved varieties would be penalized by a composite grouping. In order to secure fair averages for all varieties tried, the tables are divided into three average groups—two, three and five years respectively. It will be noted that the leading varieties in the two-year group also are the leading varieties in the three and five-year groups.

The varieties best suited to our hill conditions are as follows: Stoneville 3, Rowden 40, Miller, D. and P. L. 4-8, Stoneville 2, and D. and P. L. 6. The fertile bottom lands will support longer staples such as Missdel 1, Missdel 2, Lightning Express as well as some of the shorter staples listed above. Lands that are wilt infested should be planted to wilt resistant varieties. We have observed fields this season where the stand of cotton has been reduced as much as one-half by wilt. During a cold wet season the damage from wilt is usually much greater. Damage from this disease can be minimized if not entirely eliminated by using resistant varieties and applying a reasonable quantity of balanced fertilizer with an additional quantity of potash.

Wilt-Resistant Varieties

No cotton is wholly resistant to wilt, but the following varieties are wilt resistant to a high degree—Lightning Express, Rhyne's Cook, Dixie Triumph, Super Seven, D. and P. L. 4, D. and P. L. 4-8, Rowden 40, Miller, and Cleveland 54.

On the following pages there is an average variety test, for both the hill and valley, also variety tests for the current year.

COTTON VARIETY—HILL

VARIETY	Lint Per Acre	Lint Data			Total Value Per Acre	Bolls Per Pound
		Percent	Length	Value Per Lb.		
D. and P. L.----------10	327.4	38.6	29-32	9.70	37.49	101
Half and Half----------	387.4	47.9	11-16	8.00	35.62	84
D. and P. L.----------4-8	299.7	39.8	7-8	9.55	33.61	96
Stoneville ---------- 3	281.8	39.1	29-32	9.70	32.16	95
Stoneville ---------- 1	275.5	36.5	29-32	9.70	31.99	80
Cleveland ----------884	274.2	37.4	29-32	9.70	31.65	93
Stoneville ---------- 2	265.0	36.5	15-16	9.85	31.17	89
Miller ----------589	271.9	39.0	29-32	9.70	31.05	74
Express ----------41077	253.3	35.6	31-32	10.20	30.88	92
Acala ---------- 37	262.0	36.0	29-32	9.70	30.53	95
Express ---------- 17	247.4	35.3	31-32	10.20	30.22	101
D. and P. L.---- ---- 6	249.2	38.0	31-32	10.20	29.89	117
Roldo Rowden--------	262.1	37.5	7-8	9.55	29.84	73
Cleveland ---------- 54	285.9	37.5	27-32	8.45	29.30	92
Missdel ---------- 1	240.1	36.4	31-32	10.20	29.10	93
Cleveland Wilson ----	288.8	35.8	23-32	8.10	29.09	96
Deltatype Webber-----	214.4	33.7	1 1-16	11.10	28.44	88
Missdel ---------- 2	232.8	35.4	31-32	10.20	28.42	108
Lone Star----------561	249.2	38.0	7-8	9.55	28.27	79
Miller ----------3286	244.0	36.4	7-8	9.55	27.99	71
Lightning Express---- 7	227.0	34.7	31-32	10.20	27.93	104
Cleveland Piedmont--	272.8	35.6	3-4	8.20	27.80	86

HILL COTTON VARIETY AVERAGE

VARIETY	2 Years Average 1929-1930		3 Years Average 1928-1930		5 Years Average 1926-1930	
	Lint	Total Value	Lint	Total Value	Lint	Total Value
Stoneville ---------- 3	442.0	81.19				
Rowden ---------- 40	409.6	76.47				
Miller ---------- 589	407.2	74.28				
D. and P. L.------- 4-8	411.9	73.36	385.8	71.69	438.3	80.62
Stoneville ---------- 2	382.3	70.15	406.3	79.09		
Miller ----------	372.7	68.74	371.8	72.47	405.8	78.52
Half and Half-------	467.4	68.41	456.4	73.89	507.3	83.01
Stoneville ---------- 1	372.4	67.78	375.3	73.23		
D. and P. L.--------- 6	360.2	67.73	346.8	65.48	425.2	84.32
Missdel ---------- 2	350.0	67.21				
Cleveland ---------- 54	388.9	67.12	377.7	69.51	424.6	76.70
Lone Star---------- 561	366.2	66.35				
Lightning Express---	343.0	66.30	355.9	73.67	396.5	82.95
Acala ----------	356.2	64.97	352.9	68.38	415.4	78.74
Cleveland Wilson----	388.0	64.73	383.5	68.64	413.2	73.72
Missdel ---------- 1	332.3	62.85	315.1	63.02		
Deltatype ----------	308.0	61.67	299.0	62.92	345.7	79.36
Cleveland Piedmont-	368.2	61.29	355.2	63.13	404.3	70.47

Cotton Spacing Tests

Very extensive spacing studies were made here this season; however, the results obtained were contrary to all past experimental records. During favorable growing seasons the thicker spacing, averaging three to four stalks per foot and better, have made better yields than the thinner spacings, averaging one to one-half stalks per foot. This season, being un-

COTTON VARIETY—VALLEY

VARIETY	Lint Per Acre	Lint Data			Total Value Per Acre	Bolls Per Pound
		Percent	Length	Value Per Lb.		
D. and P. L. 4-8	705.0	38.5	29-32	9.70	98.78	84
D. and P. L. 10	779.4	36.7	15-16	9.85	91.56	87
Express 17	682.8	32.9	1 1-16	11.10	91.11	80
Stoneville 3	767.6	37.8	15-16	9.85	89.51	81
Express 41077	656.5	34.0	1 1-32	10.85	85.25	80
Stoneville 2	692.7	35.0	31-32	10.20	84.81	78
Acala 37	662.7	33.6	1	10.55	84.32	74
Cleveland 884	688.6	35.1	31-32	10.20	84.25	72
Cleveland 54	702.0	34.9	29-32	9.70	81.88	78
Deltatype Webber	550.9	30.9	1 5-32	12.20	80.76	70
Missdel 2	634.3	34.0	1	10.55	80.46	88
Lone Star 561	675.3	36.2	15-16	9.85	79.61	67
Roldo Rowden	649.9	34.9	15-16	9.85	77.35	62
Missdel 1	583.1	34.5	1 1-16	11.10	76.90	73
Miller 589	653.8	36.6	15-16	9.85	76.86	66
Cleveland Wilson	732.1	33.6	13-16	8.30	76.67	78
Stoneville 1	637.8	34.7	15-16	9.85	76.02	64
D. and P. L. 6	587.0	35.9	1 1-32	10.85	75.22	89
Half and Half	778.5	44.7	3-4	8.20	74.43	74
Lightning Express 7	539.7	32.6	1 1-16	11.10	72.18	90
Cleveland Piedmont	670.2	33.4	27-32	8.45	71.33	73
Miller 3286	598.4	34.7	15-16	9.85	71.33	60

VALLEY COTTON VARIETY AVERAGE

VARIETY	2 Years Average 1929-1930		3 Years Average 1928-1930		5 Years Average 1926-1930	
	Lint	Total Value	Lint	Total Value	Lint	Total Value
Stoneville 3	791.5	134.36				
Miller 589	721.1	125.29				
Cleveland 54	725.3	122.54	715.7	133.26	670.5	124.61
D. and P. L. 4-8	676.3	120.75	675.8	128.74	686.5	129.03
Rowden 40	698.8	119.56				
Stoneville 2	681.1	118.18	682.4	131.89		
Missdel 1	571.8	114.53	550.9	116.61		
Missdel 2	622.2	112.46				
Stoneville 1	645.2	110.87	617.6	117.62		
Lightning Express	615.9	110.83	620.5	122.87	576.8	122.54
Lone Star 561	656.7	109.95				
Miller	623.1	108.15	623.1	119.96	615.7	120.25
D. and P. L. 6	600.8	108.01	590.2	116.00	584.9	121.82
Cleveland Wilson	688.0	107.01	635.1	109.61	610.3	108.53
Half and Half	746.2	106.43	708.2	114.34	683.1	112.60
Acala	610.3	105.81	601.2	114.86	607.3	115.88
Cleveland Piedmont	647.7	99.38	618.2	106.50	607.6	107.02
Deltatype	501.3	97.25	511.0	108.90	507.4	120.86

favorable to all experimental results, we continue to recommend the thick spacing as based on average results of more favorable seasons.

Spacing recommendations—Three to four stalks per foot on hill land with rows three feet apart, and for valley land two to three stalks per foot and rows forty inches apart.

Narrow Row Demonstration

This work was started with a view of demonstrating how to produce more cotton per acre at a low cost.

The field was prepared by plowing with tractor. Rows two feet wide were used. Twenty-four hundred pounds of 4-8-4 fertilizer was applied per acre. Four bushels of Lone Star cotton seed was planted per acre. No thinning of cotton was done. The first cultivations were made with a rotary-hoe and the later cultivations with a Perry Cultivator.

The yields, as compared to an adjoining plot, using forty-inch rows and 2400 pounds of 4-8-4 fertilizer, were 1182 pounds of seed cotton per acre on the twenty-four inch row and 832 pounds of seed cotton per acre on the forty inch row.

Cotton Fertilizer Tests—Hill and Valley

The Hill Test has been conducted for only one season. Due to unfavorable seasonable conditions, and extremely poor land, it is felt that this test is not an accurate index to the fertilizer requirements of this land. All fertilized plots made a fair increase over the no fertilizer plots; however, the value of the increase was not sufficient to pay for the cost of fertilizer on most of the plots. Insufficient moisture was the limiting factor in the yields this season.

The Valley Fertilizer Test, as presented on the following pages, represents a soil fairly high in organic content, whereas, the Hill Fertilizer Test represents a soil extremely low in organic content. The Hill Test, as compared to similar tests on land having better fertility and a higher organic content, shows a remarkable contrast in the net profits per acre and the increase in yield as represented by the difference between the fertilized and unfertilized plots. The water holding properties of the organic matter in the soil is responsible to a large extent for the differences in the increase in yield and the net gain per acre.

With the poorer soils, it is highly advisable to improve the physical condition and fertility of the soil first, by planting and plowing under several leguminous green manure crops, before using heavy applications of fertilizer on cotton. Plantings of soy beans in the spring and vetch and rye in the fall will improve land wonderfully within a few years. It is best to turn these crops under; however, they may be grazed. About three or four hundred pounds of 2-8-8 fertilizer should be used on the soy beans. This fertilizer material will be available to the succeeding crop of vetch and rye if plowed under early and allowed to decay.

Fertilizers, when properly used, pay large dividends on most soils. The limiting factor in production is not always fertility. Moisture, temperature, and air are equally as important as fertility and high yields can only be made when all factors are properly correlated. Too much moisture will exclude the air from the soil and only a few of our economic plants thrive well in water or extremely wet soils. This season a lack of moisture limited the yields and in most sections only a fifty percent or less cotton crop was made. A great percent of the fertilizer applied to cotton this season was not made available to the plant due to insufficient moisture. Much of this fertilizer that was unused will be available to succeeding crops.

The effectiveness of fertilizers can be increased by improving the physi-

cal condition of the soil. There is a great need for soil improvement through crop rotations which include leguminous green manure crops. There has never been a better time to adopt a general farm diversification program with special emphasis on soil improvement.

The following tables present the fertilizer results for the Hill and Valley land tests at Holly Springs. The Hill test is for current year only, whereas, the Valley test is for the current year and also an average for six years.

The report of this Station for 1929, Bulletin 272, gives the results of the old Hill test for 1929 and also an average for five years. This table is being reprinted in this bulletin.

FERTILIZER TEST, HILL LAND—HOLLY SPRINGS
(Re-print from Bulletin 272)

ANALYSIS	Average 1929				Average 1925-1929			
N-P-K	Plot Yield	Check Yield	Increase	Net Gain	Plot Yield	Check Yield	Increase	Net Gain
No Fertilizer	482.0	482.0			503.3	503.3		
4-8-8	1038.0	522.0	516.0	22.00	1141.9	536.2	605.7	28.37
4-8-6	1034.0	562.0	472.0	19.94	1205.9	569.2	636.7	30.90
4-8-4	1028.0	602.0	426.0	17.75	1197.5	602.1	595.4	28.93
No Fertilizer	642.0	642.0			635.0	635.0		
4-8-2	1102.0	678.0	424.0	18.21	1121.8	668.0	453.8	20.76
4-8-0	1068.0	714.0	354.0	14.58	1069.6	700.9	368.7	16.08
8-8-4	1152.0	750.0	402.0	12.31	1294.4	733.9	560.5	22.48
No Fertilizer	786.0	786.0			766.8	766.8		
6-8-4	1214.0	759.0	455.0	17.49	1176.6	742.9	433.7	16.77
4-6-4	1116.0	732.0	384.0	15.89	1125.3	719.0	406.3	17.83
4-4-4	1048.0	705.0	343.0	14.10	1049.4	695.0	354.4	15.24
No Fertilizer	678.0	678.0			671.1	671.1		
4-8-4 (1200)	1248.0	664.5	583.5	19.39	1315.9	650.5	665.4	25.30
4-8-4 (1800)	1264.0	651.0	613.0	13.34	1400.4	629.9	770.5	23.84
4-8-4 (2400)	1274.0	637.5	636.5	6.94	1438.4	609.4	829.0	19.59
No Fertilizer	624.0	624.0			588.8	588.8		

FERTILIZER TEST, HILL LAND—HOLLY SPRINGS

ANALYSIS	Average 1930			
N-P-K	Plot Yield	Check Yield	Increase	Net Gain
No Fertilizer	588.0	588.0		
4-8-8	756.0	562.7	193.3	—2.11
4-8-6	742.0	537.3	204.7	—1.14
4-8-4	771.0	512.0	259.0	1.34
4-8-2	670.0	486.7	183.3	— .73
4-8-0	655.0	461.4	193.6	.20
8-8-4	811.0	436.0	375.0	1.48
6-8-4	757.0	410.7	346.3	2.43
4-6-4	674.0	385.4	288.6	3.04
No Fertilizer	360.0	360.0		
4-4-4	679.0	379.8	299.2	4.07
4-8-4 (1200)	801.0	399.6	401.4	— .92
4-8-4 (1800)	800.0	419.3	380.7	—9.14
4-8-4 (2400)	832.0	439.1	392.9	—16.19
4-10-4	673.0	458.9	214.1	— .90
4-0-0	624.0	478.7	145.3	1.17
4-8-6 (Plant Food)	666.0	498.5	167.5	—5.78
4-0-4	692.0	518.2	173.8	1.01
No Fertilizer	538.0	538.0		

All fertilizer tests, as reported in this bulletin, were conducted on plots one-twentieth of an acre in size, composed of four rows, and planted in three replications.

Only the weights of the two middle rows were used in computing results. This is done in order to minimize the experimental errors that would be caused by the intrasoil conveyance of fertilizer elements from adjoining plot.

FERTILIZER TEST, VALLEY LAND—HOLLY SPRINGS

ANALYSIS	Average 1930				Average 1925-1930			
N. P. K.	Plot Yield	Check Yield	Increase	Net Gain	Plot Yield	Check Yield	Increase	Net Gain
No Fertilizer	526.0	526.0			941.2	941.2		
4-8-8	1414.0	555.0	859.0	21.19	1688.7	946.1	742.6	33.68
4-8-6	1280.0	584.0	696.0	16.06	1582.3	951.0	631.3	27.77
4-8-4	1202.0	613.0	589.0	12.89	1518.0	955.9	562.1	24.38
No Fertilizer	642.0	642.0			960.8	960.8		
4-8-2	1200.0	712.5	487.5	9.91	1343.1	971.5	371.6	14.03
4-8-0	980.0	783.0	197.0	.32	1146.0	982.1	163.9	2.67
8-8-4	1492.0	853.5	638.5	10.70	1496.1	992.8	503.3	16.77
No Fertilizer	924.0	924.0			1003.4	1003.4		
6-8-4	1508.0	875.5	632.5	12.45	1556.8	1004.6	552.2	21.70
4-6-4	1430.0	827.0	603.0	14.05	1497.5	1005.8	491.7	20.96
4-4-4	1332.0	778.5	553.5	12.97	1408.8	1007.0	401.8	16.53
No Fertilizer	730.0	730.0			1008.2	1008.2		
4-8-4 (1200)	1516.0	734.5	781.5	12.38	1711.5	998.6	712.9	25.20
4-8-4 (1800)	1698.0	739.0	959.0	11.11	1756.5	989.1	767.4	20.44
4-8-4 (2400)	1804.0	743.5	1060.5	7.18	1809.2	979.5	829.7	16.21
No Fertilizer	748.0	748.0			969.9	969.9		

Cooperative Fertilizer Tests

It has been the policy of this Station, for a number of years, to conduct fertilizer tests on farms throughout the counties of Northwest Mississippi in order to gain specific information as to the fertilizer requirements of the several soil types. During recent years these tests have been conducted in eleven counties in Northwest Mississippi. From a careful analysis made of results obtained, it appears that there is very little difference in the general fertilizer requirements of any soils of the counties. The fertilizer recommendations for each county in the brown loam belt is practically the same. Some worn out lands will benefit in yield by an increased application of nitrogen; whereas, the so called "rust land" will benefit in yield by an increased application of potash. The basic fertilizer recommendations for this section are made in this bulletin and should be considered.

The cooperative fertilizer tests conducted in the various counties have forcefully emphasized the need of a soil building program in all the counties. Planting of legumes and the rotation of other crops with cotton will not only improve the physical and chemical conditions of the soil, but will enable the adoption of a sensible live-at-home program.

Fertilizers are needed to some extent on all of our brown loam soils; however, much of the fertilizer investment could be reduced by turning under legumes, other crops and manures, which in time will greatly improve the productivity of the land.

Cooperative Cotton Fertilizer tests were conducted this season at Mineral Wells, in DeSoto County, on the farm of Mr. E. O. Flynn and at Shannon, in Lee County, on the farm of Mr. J. B. Lauderdale.

Insufficient moisture limited the yield very materially at Shannon, however, the tests at Mineral Wells, being on fertile land of fair organic content, did not suffer quite as much. Several light showers were also reported at Mineral Wells, which helped the yields very materially.

From a study of the results of these tests, presented on the following pages, it appears that a fertilizer of about a 4-6-8 analysis is best suited to the soil types similar to those at Mineral Wells.

The Shannon test indicates a need for nitrogen and potash; however, there appears to be some discrepancy in the phosphate results. Until

COOPERATIVE FERTILIZER TEST—MINERAL WELLS

600 Lbs. per Acre	1930			
N-P-K	Plot Yield	Check Yield	Increase	Net Gain
No Fertilizer	450.6	450.6		
4-8-8	1281.0	451.6	829.4	20.15
4-8-6	1235.7	452.6	783.1	19.11
4-8-4	1209.0	453.6	755.4	18.71
4-8-2	1159.7	454.6	705.1	17.53
4-8-0	1130.4	455.6	674.8	17.04
8-8-4	1330.3	456.6	873.7	18.93
6-8-4	1215.7	457.6	758.1	16.84
No Fertilizer	458.5	458.5		
4-6-4	1246.4	456.4	790.0	20.59
4-4-4	1227.7	454.3	773.4	20.67
4-10-4	1210.4	452.2	758.2	19.15
4-0-0	1049.1	450.2	598.9	17.04
4-8-6 (Plant Food)	1267.7	448.1	819.6	17.05
4-0-4	1178.4	446.0	732.4	20.56
No Fertilizer	443.9	443.9		

COOPERATIVE FERTILIZER TEST—SHANNON

600 lbs. per Acre	1930			
N-P-K	Plot Yield	Check Yield	Increase	Net Gain
No Fertilizer	485.2	485.2		
4-8-8	914.4	495.4	419.0	5.79
4-8-6	794.5	505.5	289.0	1.82
4-8-4	713.2	515.7	197.5	— .82
4-8-2	651.8	525.8	126.0	—2.74
4-8-0	631.8	536.0	95.8	—3.23
8-8-4	763.8	546.2	217.6	—1.93
6-8-4	739.8	556.3	183.5	—3.27
No Fertilizer	566.5	566.5		
4-6-4	746.5	559.9	188.6	— .46
4-4-4	701.2	549.4	151.8	—1.09
4-10-4	843.8	540.8	803.0	2.22
4-0-0	573.2	532.2	41.0	—2.48
4-8-6 (Plant Food)	682.5	523.7	158.8	—6.08
4-0-4	898.4	515.1	158.8	8.35
No Fertilizer	506.5	506.5		

further tests can be made during more favorable seasons it appears that a 4-6-8 fertilizer or even one higher in potash is best suited to the soil types similar to those at Shannon.

Nitrogen Source Test

This test is presented as an average of 1929 and 1930 results. Six hundred pounds of 0-12-6 was applied, on an acre basis, to all plots with the exception of the No Fertilizer plots.

Thirty-six pounds of nitrogen (actual) was applied per acre, by the various materials on test, to their respective plots. All factors of planting and cultivation were as nearly uniform to all plots as was possible.

There is no material difference in the percent increase from any of the sources. Consequently, in purchasing nitrogen fertilizers, it is advisable to consider the comparative delivered cost of pounds of actual nitrogen.

MAIN NITROGEN SOURCE TEST

600 lbs. 6-12-6 N.P.K.	Average 1929-1930	
	Yield	Increase Over No Nitrogen
Nitrate of Soda	823.5	449.5
Calcium Nitrate	817.7	433.7
Cal-nitro	783.0	409.0
Leunasalpeter	759.7	385.7
Ammonium Sulphate	766.2	392.2
Calurea	749.0	375.0
Cyanamid	716.7	342.7
Ammonium Sulphate Nitrate of Soda	738.2	364.2
No Fertilizer	393.2	19.2
No Nitrogen	374	

Phosphorous Source Test

This test is presented as the average of results of 1929 and 1930. All plots, with the exception of the No Fertilizer plots, received an application of 600 pounds of 6-0-6 per acre. The phosphatic materials tried were applied, irrespective of analysis, at the rate of three hundred pounds per acre. Phosphatic applications on this soil did not pay, which may be due to the phosphorous forming insoluble compounds with iron, aluminum and silica. This will be determined and reported in a later publication.

PHOSPHOROUS SOURCE TEST

	1929-1930	
	Yield	Increase
Ruhm's Phosphate	1009.4	54.9
Super Phosphate	993.1	38.6
Colloidal Phosphate	949.9	—4.6
No Fertilizer	825.4	—129.1
No Phosphate	954.5	

Potash Source Test

The following table presents the average results for 1929 and 1930.

All plots, with the exception of the No Fertilizer plots, received an application of six hundred pounds of 6-12-0 per acre. Thirty-six pounds per acre of potash was supplied by all sources tried.

POTASH SOURCE TEST

600 lbs. 6-12-6 N.P.K.	Average 1929-1930	
	Yield	Increase
Kainit	919.4	108.2
Muriate of Potash	919.6	108.4
Trona Potash	871.3	60.1
Manure Salts	870.6	59.4
Sulphate of Potash	861.3	50.1
No Fertilizer	455.8	—355.4
No Potash	811.2	

Potash Variation Test

This test was conducted on the same type soil as used for the Source tests—poor unimproved brown loam. All plots were one-twentieth of an acre, each composed of four, forty-inch rows, and the test planted in three replications.

The increase represents the pounds of seed cotton per acre by the Potash plots over the No Potash plots. The increase obtained is in proportion to the amount of potash used. Two per cent potash making the lowest increase, 53.1 pounds, and the twelve per cent potash making the highest increase, 320.5 pounds. Even though the increase obtained from any one potash treatment, either above the No Potash plot or above the No Fertilizer plot, was large enough to pay a very substantial net profit on the potash used, the increase was insufficient to pay a net profit on the nitrogen and phosphate.

This test indicates that, even though our brown loam and clay soils of North Mississippi are recognized as having an abundance of potash by actual soil analysis, the natural potash within the soil is in combination with other elements and is largely unavailable to plant use. For maximum yields on these soils, additional heavy applications of potash are both necessary and profitable.

Increasing amounts of apparent unavailable soil elements could be made available by a change in the farming practice, whereby the action of soil bacteria and plant life within the soil could be increased in order that they might transform much of the insoluble and unavailable soil compounds into elements available to the plant.

POTASH VARIATION

600 lbs. per Acre N.P.K.	1930			
	Plot Yield	Check Yield	Increase	Percent Increase
No Fertilizer	426.6	506.2	—79.6	—15.73
8-12-0	566.5	566.5		
8-12-2	679.8	626.7	53.1	8.47
8-12-4	823.8	687.0	136.8	19.91
8-12-6	882.4	747.2	135.2	23.13
8-12-8	927.8	700.6	227.2	32.43
8-12-10	910.4	653.9	256.5	39.23
8-12-12	927.8	607.3	320.5	52.77

6-12-6 Quantity Variation

This test was conducted, for the first season, on unimproved poor brown loam soil. The increase obtained was computed as the amount of seed cotton per acre made by the Fertilized plots above the Unfertilized plots.

No net profit was realized by any of the plots. The extreme poor condition of the soil, and insufficient moisture, limited the efficiency of the applications tried. This test will be continued over a long period of time in order to ascertain the most efficient fertilizer applications as averaged during favorable and unfavorable seasons.

6-12-6 QUANTITY VARIATION

POUNDS 6-12-6 PER ACRE	1930		
	Plot Yield	Check Yield	Increase
No Fertilizer	682.5	682.5	
100 Pounds	655.8	681.0	—25.2
200 Pounds	725.2	679.5	45.7
300 Pounds	742.5	678.0	64.5
400 Pounds	813.1	676.5	136.6
500 Pounds	821.1	674.9	146.2
600 Pounds	854.5	673.4	181.1
800 Pounds	1073.3	671.9	401.4
1200 Pounds	1051.2	670.5	380.7
1600 Pounds	1061.9	669.0	392.9

Fertilizer Recommendations

After a thorough study of all fertilizer tests conducted at this Station and cooperative fertilizer tests conducted in eleven counties of Northwest Mississippi, it is evident that all of our soils are deficient in nitrogen, phosphorous and potassium. For maximum production, these elements must be supplied in some form. From a study of the nitrogen, phosphorous, and potassium source tests we find that, almost without exception, there is very little difference in the efficiency of any of the materials tried in supplying the deficient elements—nitrogen, phosphorous or potassium. A table is presented in this bulletin which will assist in the computations necessary for home mixing according to formulas.

Six hundred to nine hundred pounds of a well balanced fertilizer, per acre, will pay most seasons on soils of this section.

On improved fertile soils a 4-8-6 formula appears to be best suited. On poor soils, or "worn out soils" a 6-8-6 formula will be profitable.

On soils where cotton is subject to rust, or leaf diseases, additional potash will pay. Many of our soils are in need of heavy potash applications.

Much of the nitrogen necessary for profitable production could be very wisely and economically supplied by planting and turning under leguminous green manure crops.

POUNDS OF NITROGEN, PHOSPHOROUS AND POTASH FROM VARIOUS SOURCES REQUIRED TO MIX 600 POUNDS OF FERTILIZER ACCORDING TO FORMULA

	4%	6%	8%	10%	12%
Nitrogen					
N. Soda ----------15%	160	240	320	400	480
Calcium Nitrate --15%	160	240	320	400	480
Cal-Nitro --------20½%	117.1	175.7	234.2	292.8	351.3
Leunasalpeter ----26%	92.3	138.5	184.6	230.8	276.9
Ammonium Sul. --20%	120	180	240	300	360
Calurea ----------34%	70.6	105.9	141.2	176.5	211.8
Urea ----------46%	52.2	78.3	104.4	130.5	156.6
Cyanamid --------21%	114.3	171.5	228.6	285.8	342.9
Phosphorous					
Superphosphate ---16%	150.0	225	300	375	450
Superphosphate ---18%	133.3	200	266.6	333.3	399.9
Ruhm's Phosphate 30%	80	120	160	200	240
Potash					
Muriate of Potash 50%	48	72	96	120	144
Trona Potash ---60%	40	60	80	100	120
Manure Salts -----22%	109.1	163.7	218.2	272.8	327 3
Sulphate of Potash 48.6%	49.4	74.1	98.8	123.5	148.2
Kainit ----------12½%	192	288.0	384	480	576.0

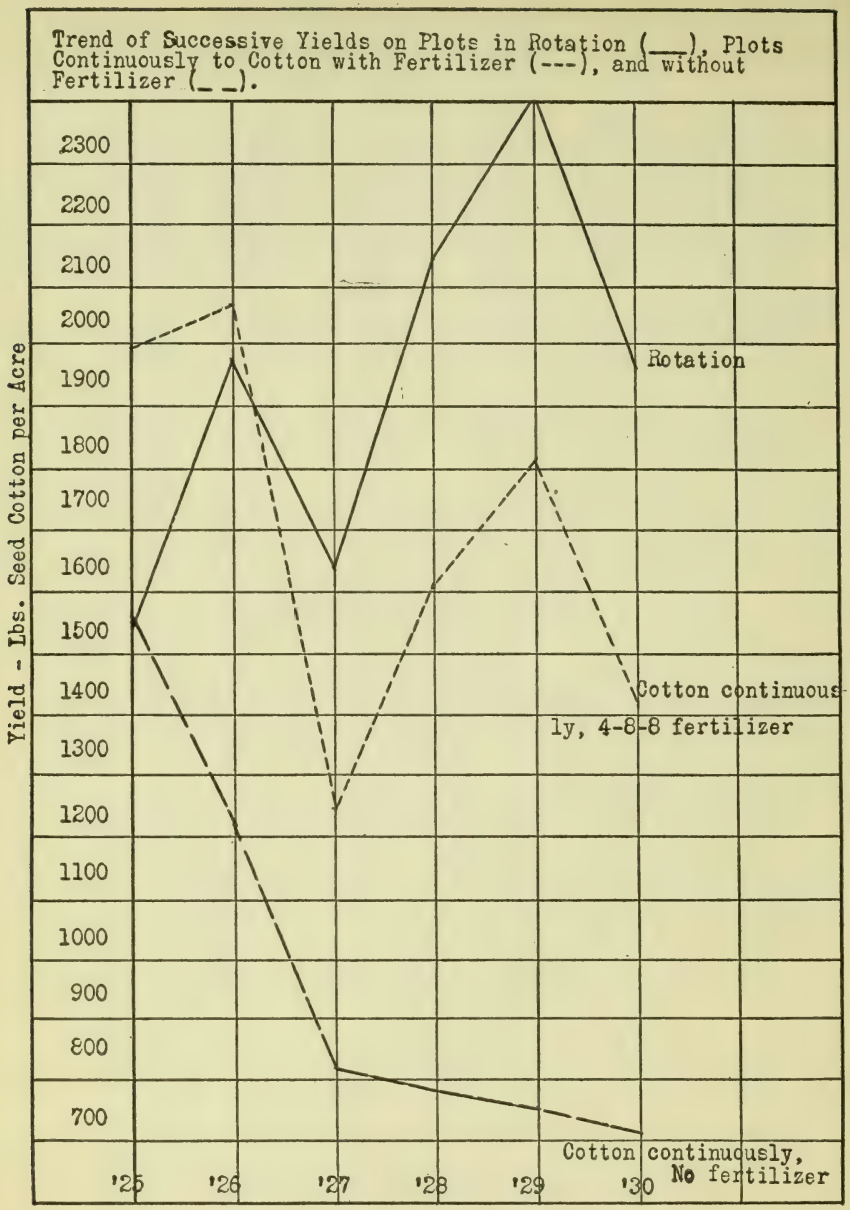
Study of the Effect of Crop Rotation Upon the Fertility of the Soil As Compared to the Effect of Continuous Planting to Cotton Upon the Fertility of the Soil

Two adjoining tracts of land, about six acres each, were built up to about the same fertility by sixteen years of crop rotation, with legumes, which increased the organic and mineral content of the soil. In 1925, a cotton fertilizer test was started on one tract and has been repeated annually since then. No summer or winter cover crops have been planted on this land since 1925.

The adjoining tract of six acres was divided into two three-acre plots and continued in a rotation, as follows: First year—Cotton was followed by vetch and the vetch was allowed to mature. Second year—Vetch was plowed under in time for corn (for grain) or sorghum silage. The corn or silage was followed by a volunteer crop of vetch. Some years the vetch was cut for hay. Third year—Volunteer vetch was plowed under in time for planting cotton. The cotton planted on this land was in a variety and spacing test which was alternated from one tract to the other. Corn and soy beans or sorghum for silage was planted on alternate years. Each year the rotation tract received the same application of 4-8-8 fertilizer as the fertilized plot on the tract planted continuously to cotton.

From these two six-acre tracts we have made a graph showing the comparison, in average yields of seed cotton per acre, of the No Fertilizer plots (continuously in cotton), to the best fertilizer plot—4-8-8 (continuously in cotton); as compared to the average yields of a good cotton variety (Cleveland 54) which was on the rotation tracts.

The graph shows that the trend of fertility on the tracts continuously to cotton is downward. Rapidly downward for the No Fertilizer plots and gradually downward on the 4-8-8 fertilizer plots. The trend of fertility on the rotation tracts is gradually upward.



The one crop system of farming, so much in evidence in the South, is rapidly making the soils poorer. There is no such thing as a permanent soil fertility. As we draw on our lands for produce we are gradually or rapidly making them poorer, unless we replace some of the fertility by returning to the soils equal amounts of mineral and organic material. This can be done wisely and economically by planting other crops in rotation

with cotton. Legumes and grain crops have a wide range of adaptability for the purpose of rotations in our farming program. The South can never prosper as long as it adheres to a one crop system of farming.

Corn Variety Test

The corn variety test for the current year is considered of no value due to poor stand and unfavorable seasonal conditions. A presentation of results of this test is made as extending over a period of four years. The following table presents the average of these varieties.

The Mosby and Paymaster strains have always been very satisfactory varieties for this section. The Mosby seems to be a bit superior during a wet season as it is not as much subject to rot. Hastings has always made good yields; however, it has a small cob. Cooke's Prolific is an excellent corn, there is some objection made to the hardness of the grain which seems to be harder to digest, by stock, than some of the other varieties.

There is a great need for a heavy yielding yellow corn for this section.

CORN VARIETY AVERAGE

VARIETY	4 Years Average—1926-1929	
	Bushels Grain to Acre	Percent Grain
Hastings	70.7	82
Paymaster, Fisher	70.1	80.8
Cocke's Prolific, Station	65.4	78.2
Paymaster, Neal	64.6	80.2
Mosby, Station	63.2	79.8
Mosby, Delta	61.3	80.8
Cocke's Prolific, Delta	61.0	80.7
Mosby, Suttle	58.6	82.3
Laguna	54.2	77.3
Golden Dent	49.1	73.7
Mexican June	48.0	76.4
Yellow Dent, Station	44.8	76.3

SAGRAIN

About twenty acres of thin land were planted in sagrain and soy beans in rows together for grain and hay. The drouth delayed the growth of these crops, but they waited for rains and then began growing again and made fair crops. The best mature heads were cut and cured in a potato curing house for seed or mule feed, then the stalks and soy beans were cut and put in the silo for dairy cows, as the barns were already full of soy bean hay.

The heads on a small plot were allowed to mature and the weight of the heads and the green silage were secured. There were 2570 pounds of dry heads which thrashed out 43.7 bushels or 2450 pounds of shelled grain per acre. There were 10384 pounds of green silage per acre. One great advantage in favor of this crop over corn in this section as an emergency crop for late planting is that it will stand drouth better, wait longer for rains, and then usually make a good crop on fertile land before frost. The tops can be cut for grain or mule feed and the stalks for hay or silage. When planted with soy beans it makes fine hay. Sagrain is considered hard on land and should not be planted on the same land often.

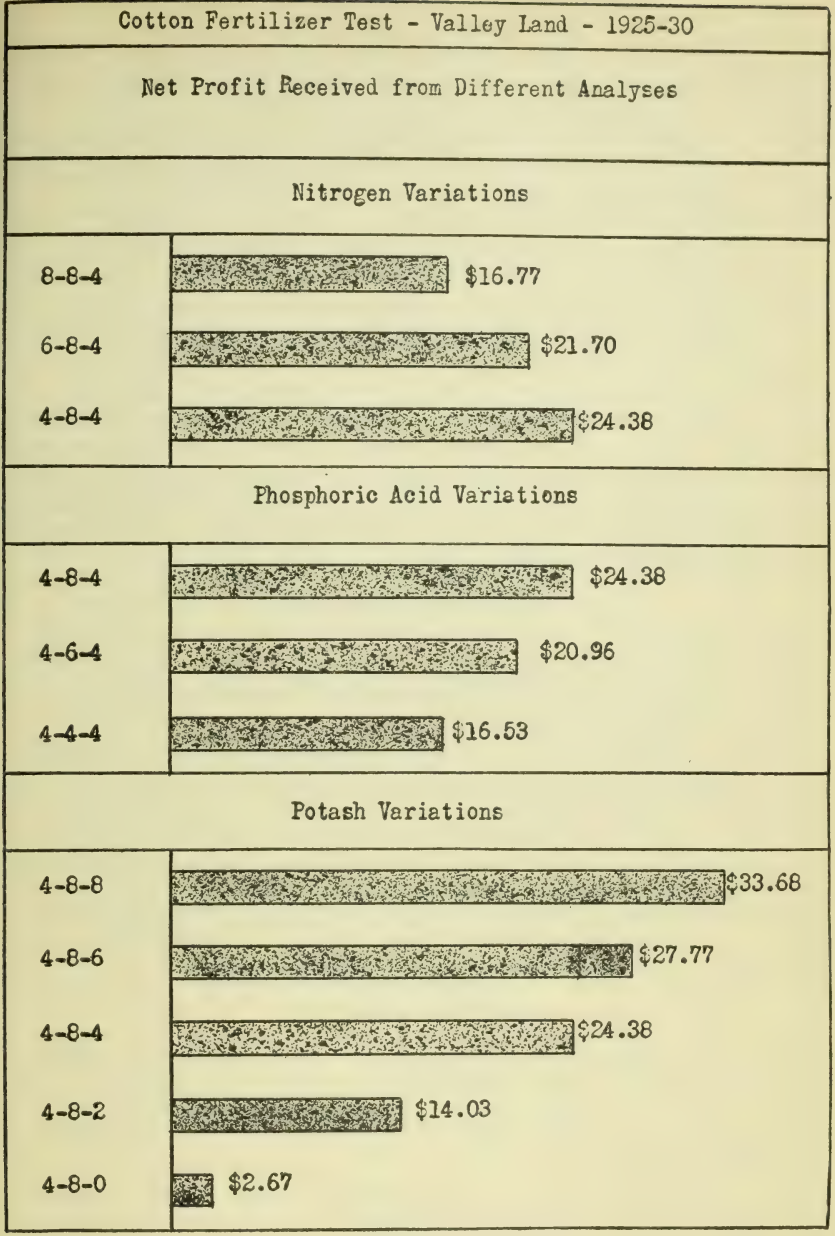
Sagrain was not placed on a comparative test with corn; however, during this extremely dry growing season satisfactory yields of grain were made by sagrain while corn on more fertile ground was a complete failure.

While sagrain shows merit as an excellent emergency feed crop, it is felt that it is inadvisable to consider general farm planting of this crop in preference to corn. Sagrain in combination with soy beans will make an abundance of feed during favorable seasons; however, corn is usually more satisfactory. The practice of harvesting sagrain by grazing may be more favorable to this crop than cutting heads for feeding through the winter. The heads are hard to cure unless allowed to mature thoroughly in the field.

The main objection to this crop is in the damage wrought by the Sorghum Midge during the damp blooming period. It should not be planted as an early crop.

Japanese and Texas seeded cane are both superior, in tonnage production, to sagrain or corn for silage. Sorghum silage is the most satisfactory succulent feed crop that we have ever produced.

Sorghum silage crops produce heavy tonnage and consequently remove much fertility from the soil. Heavy applications of balanced fertilizer should always be used.


Cotton Fertilizer Test - Valley Land - 1925-30
Net Profit Received from Different Analyses
Nitrogen Variations
8-8-4
$16.77
6-8-4
$21.70
4-8-4
$24.38
Phosphoric Acid Variations
4-8-4
$24.38
4-6-4
$20.96
4-4-4
$16.53
Potash Variations
4-8-8
$33.68
4-8-6
$27.77
4-8-4
$24.38
4-8-2
$14.03
4-8-0
$2.67

LIME REQUIREMENT STUDIES

During the fall of 1929 a field of eighty plots of one-twentieth acre each and practicaly uniform soil was laid off for lime requirement studies. Half of these plots received no lime and half of them were given an application of lime at the rate of three tons per acre. Eight different kinds of winter cover crops were planted on this field and each were on a limed and an unlimed plot adjoining each other. There were five series of sixteen plots each. These cover crops failed on account of the severe winter.

In the spring of 1930 all of these plots were planted in soy beans for hay. The hay was cut, cured and weighed from the different plots. The unlimed plots produced at the rate of 2664 pounds of soy bean hay per acre and the limed plots 3225 pounds, or a gain of 561 pounds of hay per acre by the application of three tons of lime. The increase in yield of soy bean hay for the first year has practically paid for the liming, and of course we are expecting this application of lime to continue to have effect for several more crops without any additional expense. This field has also been planted in the same kind of winter cover crops again this fall and they look very promising at this time, December 24, 1930. This gives the results of only one season but more extensive studies are to be made along this line the following seasons.

WINTER COVER CROPS

A mixture of one bushel of Abruzzi rye and twenty pounds of hairy vetch to the acre is the main winter cover crop planted this fall to be turned under next spring for soil improvement. About thirty acres were planted in the above mixture this fall.

Fifteen acres of wheat and vetch were planted as a winter cover crop and for hay and grain in the spring if needed. Oats and vetch were planted on five acres. About ten acres were divided into plots and planted in various winter cover crops to determine their comparative value as green manure when turned under for the succeeding crop. A total of about sixty acres were planted in winter cover crops this fall. Most of these crops are to be turned under in the spring and some of the land is to be planted in cotton and part of it in corn and sagrain. These cover crops all look very promising at this time, December 24, 1930.

ROTATION STUDIES

Rotation studies consisting of eighty plots were started this fall with winter cover crops for corn and sagrain compared with corn and sagrain without cover crops. These cover crops were planted October 2nd, and checks without winter cover crops were prepared in the same manner but left unplanted. These cover crops are to be turned under in the spring and four series of ten plots each are to be planted in corn and four series in sagrain. A record is to be kept of the yield of corn and sagrain and the results will probably be published later.

Vetch

In September, 1929, a very extensive vetch variety study was started in cooperation with the Bureau of Plant Industry of the United States De-

partment of Agriculture. Thirty-one plots, one-twentieth of an acre each, were planted to vetch and pea varieties in order to study the relative growth, adaptability, and winter hardiness. Due to the severely cold winter of 1929 and 1930, nearly all of the plantings were killed with the exception of the following, which are arranged in accordance with their relative resistance to winter killing:

Excellent:

Common Hairy Vetch,
Oregon Hairy Vetch 18004.

Fair:

Common Vetch 02830,
Common Vetch 18003.
Hungarian Vetch,
Imported Hairy Vetch 15760,
Austrian Pea,
Monantha Vetch.

The Common Hairy Vetch and Oregon Hairy Vetch appears to be the most satisfactory vetches for general planting in this section. Other vetches are being tried and will be reported later if of merit.

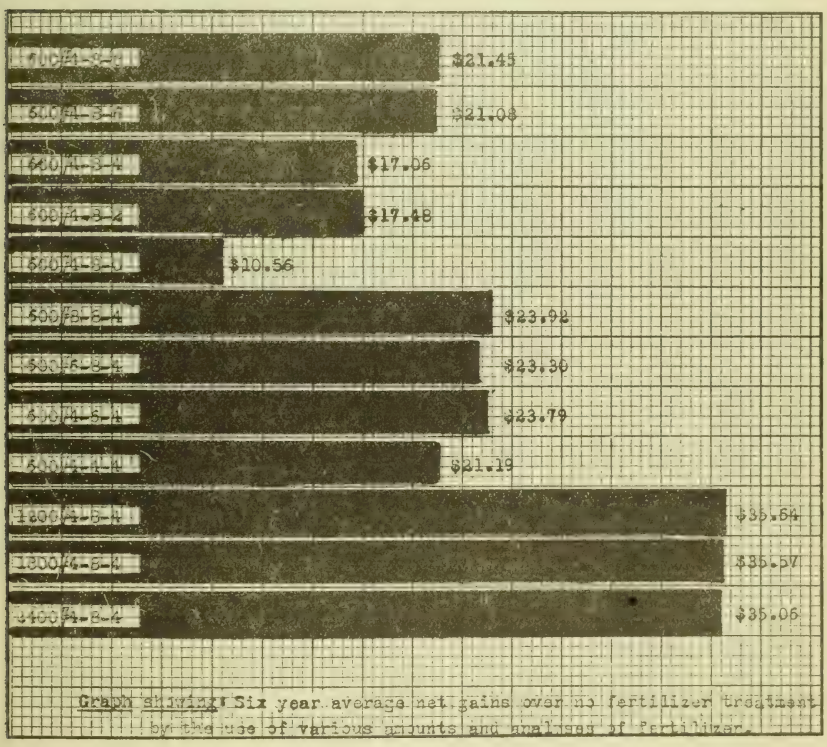
A general discussion of vetch has been made in Mississippi Circular 72 published by this Station.

Bulletin No. 287 December, 1930

REPORT OF THE RAYMOND BRANCH EXPERIMENT STATION

By

H. F. WALLACE



Graph showing Six year average net gains over no fertilizer treatment by the use of various amounts and analyses of fertilizer.

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi.

W. R. PERKINS, Director.

REPORT OF WORK AT THE RAYMOND BRANCH EXPERIMENT STATION, 1930

By H. F. WALLACE

INTRODUCTION

This report contains a summary of the work conducted on the Raymond Branch Experiment Station for the year of 1930. Many tables herein will give averages for a period of years, whereby results with various fertilizers and varieties will be more accurate. Other publications from this station may be secured upon request from the Mississippi Experiment Station, A. and M. College, Mississippi.

Experiments were expressly conducted to determine the kinds and quantities of fertilizers, varieties and cultural methods of cotton, corn, legume and truck crops best suited for the southern section of the Brown Loam soil area. Various inoculating materials for legumes have been tested and found to give about equal results. The boll weevil has been successfully poisoned and for the past three years nicotine mixtures have held the plant lice in check after applying the calcium arsenate. Beneficial results have been obtained with pruning, spraying and fertilizing fruit trees and grapes.

All fertilizer formulae used in this report will be given in the order of (N. P. K.) nitrogen, phosphoric acid and potash; that is, we have a 4-8-4 in the place of our well known "8-4-4". This is in accordance with an agreement entered into with the National Fertilizer Association and Northern Experiment Stations in order to put our southern Experiment Station work on the same basis with theirs. Permit us to impress that a 4-8-4 means four per cent of the fertilizer is nitrogen in an available form, eight per cent is phosphoric acid and four per cent is potash.

As a crop year, 1930 presented many obstacles to the farmer. The fall rains of 1929 extended well into the spring of 1930. The early season was wet and truck crops were somewhat delayed, but later produced good crops for which there was practically no demand. The wet season ended with a very heavy rain on May 18th. It has befallen our lot to gaze upon countless acres planted to corn that the harvester's wagon never entered. Many small fields planted to sorghum barely attained a height of eight inches before wilt overcame it due to the drought. Many farmers in these very dry areas would have made no feed at all had they not planted soybeans in their corn. Soybeans made fair crops where the corn failed. Let us urge here the planting of soybeans in every row of corn in Mississippi. It pays dividends every year. Cotton that was fertilized and worked regularly came thru the drought with flying colors. Our twenty acres in cotton plats produced slightly over twenty-six five-hundred pound bales. The corn crop on the station farm averaged about thirty-five bushels per acre.

Over 1500 visitors came to the station during 1930. This represents the largest visitors roll in the history of the Raymond Station. No doubt these annual visits to the various experiment stations are bearing their share of fruit.

We gratefully acknowledge the assistance rendered by our capable farm manager, Mr. J. C. Peyton.

COTTON

Cotton represents the principal cash crop of our state and the 1930 production in Mississippi has been estimated at 1,500,000 bales; hence much attention has been given this crop from a standpoint of varieties, fertilizers, boll weevil control, spacing and disease. At least ninety per cent of our visitors were interested in cotton more than anything else.

The 1930 crop was considerably reduced due to the ravages of the army

worm and the extreme drought in many localities. The ten year average production for Mississippi (1919-1928) is 1,182,000 bales, while this year's crop is estimated at 1,500,000 bales. The 1929 crop was 1,915,000 bales. The ten year average lint production per acre is 176 pounds, while it is estimated at 169 pounds this year. The 1929 lint production for our state was 225 pounds per acre. For the United States, the average lint production per acre is estimated at 150.8 pounds for 1930, while the ten year average is 155.1 pounds per acre. Extreme dry weather caused much premature opening.

Below may be seen the results of twenty-six leading varieties of cotton which were planted on both valley and hill land, as shown in table 1 for the valley land test, and table 2 for the hill land test.

TABLE 1—COTTON VARIETY TEST—VALLEY LAND—1930

Variety	LINT DATA				Total	
	Lbs. lint per acre	Lint percentage	Staple Length	Value per lb.	Value per acre	Rank
1. Cleveland-54	933.3	35.1	15-16	9.85	$110.91	3
2. Miller-589	914.2	35.6	31-32	10.20	111.44	2
3. Stoneville-3	887.1	36.4	31-32	10.20	107.53	6
4. D. & P. L. No. 4-8	874.4	36.8	15-16	9.85	102.35	13
5. Cleveland-54	860.0	33.7	15-16	9.85	103.32	10
6. D. & P. L. No. 10	857.5	34.9	1 1-32	10.85	110.63	4
7. D. & P. L. No. 6	845.0	33.8	1 1-16	11.10	112.00	1
8. Roldo Rowden	830.5	33.5	31-32	10.20	102.84	11
9. Cleveland-54	813.0	34.7	15-16	9.85	96.91	17
10. Delfos-911	803.6	31.7	1 3-32	11.30	109.86	5
11. Acala-37	796.5	32.0	1	10.55	102.71	12
12. Stoneville-2	795.7	33.7	1 1-32	10.85	103.55	9
13. Lone Star-561	795.5	35.9	31-32	10.20	96.77	18
14. Express-17	794.2	32.1	1 1-32	10.85	104.65	7
15. Lone Star-65-R	765.6	33.3	1	10.55	97.64	16
16. Half & Half Summ.	759.4	43.2	3-4	8.20	73.25	25
17. Express-41077	757.2	33.4	1 1-16	11.10	100.66	14
18. Missdel-1	748.9	33.33	1 1-8	11.65	103.75	8
19. Lightening Exp.-7	723.1	31.4	1 3-32	11.30	99.09	15
20. Stoneville-1	716.2	33.5	1	10.55	91.20	20
21. Wilson-Type	711.2	32.4	7-8	9.55	84.24	22
22. Missdel-2	703.2	32.6	1 1-32	10.85	92.29	19
23. Miller-3286	680.3	33.2	31-32	10.20	84.45	23
24. Cleveland-884	673.5	34.7	31-32	10.20	82.64	24
25. Cleveland-Pied	637.3	32.3	27-32	8.45	68.15	26
26. Deltatype Web.-8	531.3	30.0	1 3-16	13.10	83.24	23

TABLE 2—COTTON VARIETY TEST—HILL LAND—1930

Variety	LINT DATA				Total	
	Lbs. lint per acre	Lint percentage	Staple Length	Value per lb.	Value per acre	Rank
1. Cleveland-54	700.1	39.8	13-16	8.30	$69.76	2
2. Half & Half-Summ.	694.3	47.2	11-16	8.00	64.08	5
3. Wilson Type	597.5	38.5	25-32	8.20	59.50	12
4. Cleveland-54	594.7	39.7	27-32	8.45	60.19	9
5. D. & P. L. No. 4-8	592.9	41.0	7-8	9.55	66.00	4
6. Stoneville-3	590.6	39.4	29-32	9.70	67.28	3
7. Delfos-911	579.4	35.2	1	10.55	72.86	1
8. Cleveland-54	565.4	38.4	13-16	8.30	56.95	18
9. D. & P. L. No. 10	553.9	37.5	29-32	9.70	63.88	6
10. Miller-589	531.6	39.7	29-32	9.70	60.45	8
11. Lone Star-561	522.4	38.1	29-32	9.70	60.00	11
12. Cleveland-Pied	516.6	38.1	3-4	8.20	51.59	22
13. Stoneville-2	515.1	37.9	15-16	9.85	60.02	10
14. Acala-37	511.8	36.9	29-32	9.70	59.27	12
15. Missdel-2	495.1	35.4	31-32	10.20	57.33	17
16. Lone Star-65-R	494.8	35.7	15-16	9.85	58.54	14
17. Express-41077	491.1	36.9	1	10.55	61.05	7
18. Cleveland-884	489.8	38.6	29-32	9.70	56.08	19
19. Stoneville-1	469.3	36.1	15-16	9.85	49.03	24
20. D. & P. L. No. 6	468.3	36.7	1	10.55	58.29	15
21. Roldo Rowden	467.7	37.3	29-32	9.70	54.02	21
22. Missdel-1	461.0	36.5	1	10.55	57.46	16
23. Lightening Express-7	446.2	34.3	31-32	10.20	54.91	20
24. Miller-3286	409.6	36.9	29-32	9.70	47.43	25
25. Express-17	376.6	34.9	31-32	10.20	46.14	26
26. Deltatype Web.-7	366.8	32.4	1 3-32	11.30	49.86	23

Recommendations—For hill land, it has been found that Cleveland-54, D. & P. L. No. 8 and 10, Stoneville 2 and 3, the Lone Star, Wilson Type and Cook-1010 are good. The latter two are somewhat short but turn out well at the gin. The other varieties, including Miller 589, normally pull an inch or better.

For valley land, Delfos-6102 and any of its progenies, and of the Lone Star strains, the Stoneville strains, the Millers, Cleveland154, Express-121 and D. & P. L. No. 6 and 8, Roldo Rowden and Missdel 2 are all good. If wilt is prevalent, then Cleveland-54 or Cook-1010 will probably give best results. To maintain length of staple in the long varieties, always plant them on strong land. Many long staple varieties are planted on poorer classes of soil and when the staple is classed, the cotton buyer sometimes gets the credit for shortening the length, instead of the soil which is usually responsible. Then, too, improper gin speeds often cuts the fibers. A laboratory experimental gin is now being erected at our Stoneville station by the federal government to test various gin speeds and methods of ginning. Mississippi was indeed fortunate in securing this federal project.

The valley land test has been conducted for a period of ten years, while this is the fourth year for the hill land test. Each test was poisoned twice for the army worm, August 1 and 9th, 1930. Some boll weevils were present at this time, but not in alarming numbers. The valley test was planted April 25, after turning under a fine crop of rye and vetch and applying 800 pounds of a 4-8-4 fertilizer per acre. The hill test was planted April 24, following similar conditions as stated above. The results of the rye and vetch turned under was very evident all during the hot, dry summer. The valley test was in five series and the hill test planted in four series.

Fertilizers—Nearly all of the 1500 visitors to this station the past year were interested in fertilizers for cotton. Farmers not acquainted with the use of fertilizers with cotton are astounded when shown that about ten dollars worth of a well balanced fertilizer put under an acre of cotton will double the yield on fairly good land. Many farmers are of the opinion that fertilizers are profitable only on poor land.

Again we are inclined to quote Mr. P. D. Ratliff, Raymond, Miss., a prominent lawyer and planter and a friend of the station, who sums up what fertilizers will do for you as compared with ordinary labor as follows:

"It will work night and day, when it is raining, on Saturday afternoons and when you are asleep. It will not eat anything, will not worry you, will not break up or wear out, pack off or steal anything from you. Will not run off and leave you and will always come home in the fall and bring back the dollar you paid for it and generally brings along two, three, four or five dollars as company to put into your pocket as a profit."

In testing kinds of fertilizer it is also imperative to test quantities, so varying amounts up to 2400 pounds per acre have been used on the station. A six year average net gain with 2400 pounds per acre, after paying for the fertilizer, was $35.06 greater than the value of the yield of the unfertilized plats. During the same period the 1800 pound application produced a net gain of $35.57 and the 1200 pounds of 4-8-4 produced a net gain of $35.64, indicating that a 1200 pound application is about the most profitable limit.

In most of our fertilizer work reported in this bulletin, the increase was obtained according to the standard adopted by the American Society of Agronomy as reported in volume 16, number 1 of the Journal. The column marked "check yield" was obtained according to the above method by assuming that there is a gradual increase or decrease in fertility of the soil from one plat to another.

Below is to be found the general fertilizer test conducted on the station as listed in table 3:

TABLE 3—FERTILIZER ANALYSIS TEST WITH COTTON—1930

Nitrate of Soda	Super-Phosphate	Murite or Potash	Analysis	Pounds of seed cotton per acre: Plat Yield	Check Yield	Pounds Increase	Dollars per Acre: Inc. Value @ 3½c	Cost of Fert.	Value Net Gain
		No Fertilizer		1095	1095				
160	300	100	4-8-4	1561	1061	500	17.50	9.33	8.17
240	300	75	4-8-6	1538	1028	510	17.85	8.73	9.12
160	300	50	4-8-4	1393	994	399	13.96	8.13	5.83
		No Fertilizer		961	961				
160	300	25	4-8-2	1332	948	384	13.44	7.53	5.91
160	300		4-8-0	1134	936	198	6.93	6.93	
320	300	50	8-8-4	1589	923	646	22.61	12.81	9.80
		No Fertilizer		911	911				
240	300	50	6-8-4	1527	926	601	21.04	10.47	10.57
160	225	50	4 6-4	1491	941	550	19.25	7.57	11.68
160	150	50	4-4-4	1459	956	503	17.61	7.00	10.61
		No Fertilizer		971	971				
320	600	100	4-8-4	1956	964	992	34.72	16.26	18.46
480	900	150	4-8-4	1923	957	966	33.81	24.39	9.42
640	1200	200	4-8-4	2040	950	1090	38.15	32.52	5.63
		No Fertilizer		943	942				

Remarks: This test was planted in three series to Lone Star-65 cotton on April 23, 1930, after having been fertilized on April 16th. A good stand was secured, but was damaged slightly by a six inch rain that fell on the night of May 18, 1930. Records were taken from the three inside rows on each plat of five rows to eliminate variations that might be caused from the stealing of the fertilizer by the plants on the outside rows of each plat. A study of boll sizes revealed that well balanced fertilizers have a tendency to produce larger bolls.

Recommendations—For general conditions, 600 pounds per acre of a 6-8-4 should give good results. On old cotton lands, where cotton "rusts," or where lespedeza has preceded cotton, it is advisable to use eight per cent of potash instead of four. If the land is heavily infested with coco or Johnson grasses, then apply only half of the nitrogen before planting and use the other as a side dressing after chopping. Heavy red clay hill sides may not need potash in some instances, but to insure full returns from the nitrogen and the phosphorus, it is best to apply about four per cent. Always remember that fertilizers judiciously used pay as well on fertile as it does on the poor soils.

Where legumes have been previously grown and turned under, then four per cent of nitrogen in a formula should be sufficient. In following heavily fertilized truck crops of the year before with cotton, it may be safe to reduce the phosphorus and potash to one-half and reduce the nitrogen to four per cent.

Where a "show patch" is wanted, use 1000 pounds per acre of a 4-8-4 under the crop about two weeks before planting and side-dress with 200 pounds per acre with nitrate of soda or the equivalent with some other quick acting nitrogen.

Factory versus Home-mixed Fertilizers—This is the third year this test has been conducted. Stock-run commercial 4-8-4 fertilizers were secured from the Jackson Fertilizer Company and the Meridian Fertilizer Factory and nitrophoska (15-30-15) a highly concentrated fertilizer and plant food, a 4-8-4 with cotton seed hulls as the filler, were used against home-mixed 4-8-4 goods using 16 per cent superphosphate and Rhum's phosphate of 34 per cent for the phosphoric acid, Chilean nitrate of soda for nitrogen and

muriate of potash for the potash. All fertilizer was applied at the rate of 800 pounds per acre, making the nitropheska application at the rate of 208 pounds per acre.

This test was fertilized April 17 and planted in five series to Lone Star-65 cotton on April 22, 1930. Each plat consisted of five rows and the records taken from the three inside rows.

TABLE 4—FACTORY VERSUS HOME-MIXED FERTILIZERS—1930

Fertilizer used per acre	Pounds of Seed Cotton per Acre 1929-30					
800 Lbs. of a 4-8-4 or 200 Lbs. of a 15-30-15	Plat Yield	Check Yield	Increase 1930	Increase	Rank	3 Year Av Rank
No Fertilizer	1343	1343				
Jackson 4-8-4	1686	1343	343	312	5	2
Home Mixed 4-8-4 (Superphos)	1626	1343	283	338	3	3
Nitrophoska-15-30-15	1638	1343	295	272	6	5
No Fertilizer	1343	1343				
Meridian-4-8-4	1719	1344	375	340	2	1
Home Mixed 4-8-4 (Rhum's)	1715	1345	370	313	4	4
Plant Food-Canton 4-8-4	1819	1346	473	379	1	
No Fertilizer	1347	1347				

NOTE: The fertilizer listed as Plant Food—Canton was tested two years only.

Nitrogen Sources—Many forms of nitrogen are being offered farmers these days, and in turn, they look to the experiment station for advice as to which will give the best results. Due to this fact, quite a bit of attention has been given as to finding the best source of nitrogen to use in mixing fertilizers. One test which is listed in table 5 has been conducted for six years and a new test as listed in table 6 has been conducted for two years.

The old test was fertilized April 16 and planted in three series to Lone Star-65 on April 23, 1930. The new test was fertilized and planted May 3, 1930. Good stands were secured in each instance.

The results for the past year gives calcium cyanamid the lead in the old test, but the six year average shows urea to hold first place, closely followed by calcium nitrate, leunasalpeter and chilean nitrate of soda. In the new test, every nitrogen paid nice dividends but the two year average gives nitrate of soda the lead with calnitre coming second. It was evident that much nitrogen was not used until the fall rains started and then it was too late to really benefit cotton. On other fields where winter legumes and rye are now planted broadcast, one can easily see where fertilizer was applied in the drill last spring.

TABLE 5—NITROGEN SOURCE TEST WITH COTTON—1930

	POUNDS OF SEED COTTON PER ACRE			SIX YEAR AVERAGE	
Pounds of Material applied per acre	Plat Yield	Check Yield	1930 Increase	Increase	Rank
No Nitrogen	1711	1711			
Nitrate of Soda	1809	1695	114	235	4
Sulphate of Ammonia	1869	1679	190	215	5
Leunasalpeter	2019	1664	335	251	3
No Nitrogen	1648	1648			
Calcium Cyanamid	2082	1661	421	212	6
Calcium Nitrate	1918	1675	223	270	2
Urea	1992	1688	304	287	1
No Nitrogen	1702	1702			

TABLE 6—NEW NITROGEN SOURCES TEST WITH COTTON—1930

Sources of Nitrogen	LBS. OF SEED COTTON PER ACRE			1929-30 AVERAGE	
	Plat Yield	Check Yield	1930 Increase	Increase	Rank
Nitrate of Soda	2168	1670	498	418	1
No Fertilizer	1556	1670	-114	-190	13
No Nitrogen	1670	1670			12
Calcium Nitrate	2055	1670	385	299	6
Nitrate of Soda	2058	1670	388	359	2
Sulphate of Ammonia	1987	1670	317	223	9
Calurea	2089	1670	419	339	4
Ammophos	1826	1670	156	36	11
Nitrate of Soda	2083	1670	413	302	5
Leunasalpeter	1916	1670	246	193	10
Cal Nitro	2012	1670	342	344	3
40% Sul. Amm. and 60% Ni. Soda	1983	1670	313	258	8
Nitrate of Soda	2014	1670	344	297	7

Phosphorus Sources—This is the second year that a test of this nature has been conducted at this station. The fertilizer was applied at the rate of 508 pounds per acre on April 29 and the test was planted to Lone Star-65 cotton on May 1, 1930. Plats consist of five rows, each 125 feet long, and there were ten series. Superphosphate is far in the lead of Rhum's phosphate or ammophos. The Rhum's phosphate was applied on a cost basis with superphosphate. Records were kept from the three inside rows.

TABLE 7—PHOSPHORUS SOURCES TEST—1930

Formula and Source	LBS. OF SEED COTTON PER ACRE			1929-30 AVERAGE	
	Plat Yield	Check Yield	Increase	Increase	Rank
6-12-6 (Superphosphate)	1442	1390	52	143	2
6-9-6 No Phosphorus	1390	1390			
6-24-6 (Rhum's Phosphate)	1364	1390	-26	43	4
6-12-6 Ammophos	1473	1390	83	66	3
6-12-6 (Superphosphate)	1474	1390	84	159	1

Potash Sources—Several forms of potash are listed on the market these days and to be able to answer questions regarding these forms or sources, a very extensive potash test has been conducted for the past two years. Last year sulphate of potash magnesia slightly led sulphate of potash which came second. A two year average puts sulphate of potash in the lead, however, with sulphate of potash-magnesia second and muriate of potash third. Kainit and manure salt also show up well. Results may be seen in the table listed below.

When cotton "rusts" badly, it signifies a deficiency of potash plant food in the soil and an application of 100 pounds per acre of muriate or sulphate of potash or 400 pounds of 12 per cent kainit will very probably correct this condition. In our plats this year, as well as the two years before, those receiving potash in any form hold their foliage a month longer than the checks and no potash plants. It is evident in this case that nitrogen and phosphorus do their share in maintaining a vigorous healthy plant, but it remains in the power of the potash to cause the plant to retain its leaves. It is our opinion that a liberal application of a well balanced fertilizer and pure seed will do more to ward off plant diseases than anything else. On all old cotton lands, there is no doubt but that it would be advisable to use at least eight per cent potash in a fertilizer formula to be used under cotton.

This test was fertilized May 2 and planted in four series to Lone Star-168 on May 3, 1930, on land that is suffering for want of potash. Plats consist of five rows each, 125 feet long, but records are taken from the three inside rows. Poison was applied August 1 and 9 to control the army worm.

TABLE 8—POTASH SOURCES TEST WITH COTTON—1930

Sources of Potash	800 Lbs. per Acre of Formula used	LBS. OF SEED COTTON PER ACRE			1929-30 Average Increase
		Plat Yield	Check Yield	1930 Increase	
Muriate of Potash	6-12-6	2070	1605	465	364
No Potash	6-12-0	1605	1605		
No Fertilizer	None	1171	1605	-434	-465
Kainit	6-12-6	2284	1605	679	444
Muriate of Potash	6-12-6	2288	1605	683	494
Sulphate Pot. Magnesia	6-12-6	2271	1605	666	510
Sulphate of Potash	6-12-6	2374	1605	769	548
Manure Salt	6-12-6	2171	1605	566	417
Muriate of Potash	6-12-6	2145	1605	540	401

Cotton Spacing Work—Our spacing work was ruined this year by the heavy rain of May 18th. However, the cotton grower of today realizes that to get high yields, a good stand must be secured. To insure a good stand, plant one and one-half bushels of seed on well prepared, slightly elevated rows per acre from April 10 to the 25th and then hoe and side dress your early corn and soybeans with a good form of nitrogen. In the meantime the cotton germinates and if it should get grassy, run around it with a side-harrow. Do this twice if necessary, but permit the cotton to get some growth before chopping and the weak plants will probably die out during this time and then it will be a hard proposition for any hand to cut out many of the pretty stalks. Bear in mind that the young cotton plants should become well established before chopping takes place.

A five year average indicates two to three stalks in bunches per foot on three and one-half foot rows on valley land.

For hill land, use three foot rows and leave three to five stalks in bunches every foot. The poorer classes of soil will stand much closes spacing than the fertile soils. Quick maturing, medium sized, small leaved varieties will also stand closer spacing than the slow growing large leaf varieties. More cotton can be made on fewer acres by the proper use of fertilizer, good varieties, practical cultural methods and close spacing as has been recommended above.

Seed Treatment for Seed-Borne Diseases of Cotton—Tests were made again this year in co-operation with the Department of Plant Pathology of the Experiment Station and the State Plant Board, the plan and treatment being furnished by Dr. L. E. Miles, Pathologist, A. & M. College, Mississippi. The sale of these organic mercury disinfectants is being pushed in this territory by commercial organizations and to be able to answer inquiries as to the effectiveness in disease control, this work was continued this year.

Below are the tabulated results in table 9:

TABLE 9—SEED TREATMENT WORK—COTTON—1930

Seed Treatment	LBS. SEED COTTON PER ACRE			1929-30 AVERAGE	
	Plat Yield	Check Yield	Increase	Increase	Rank
No Treatment	1675	1675			
Ceresan	1839	1720	119	66	4
Semesan	1922	1766	156	127	2
Semesan, Jr.	1922	1811	111	87	3
K. I. X.	2056	1857	199	133	1
Corona Merco	1882	1902	20	64	5
Delinted (H_2SO_4)	1972	1948			
No Treatment	1993	1993			
Calochlor	2065	1962	103		
Calogreen	2122	1930	192		
Anshacher-Aigle	1920	1899	21		
Du-Bay-655	1981	1867	114		
Du-Bay-681	1848	1836	12		
No Treatment	1804	1804			

Remarks—The above test was fertilized with 800 pounds of 4-8-4 per acre on April 17th and planted in three series to Lone Star-561 cotton on April 28, 1930. A quantity of seed was divided into equal parts and each part received a treatment of some nature except the checks. Plats consist of five rows, each 125 feet long. Records were made from the three inside rows.

The treatment K. I. X. gave an increase of 199 pounds of seed cotton for 1930 and leads the two year average with 133 pounds seed cotton increase. Calogreen came second in 1930 with 192 pounds and Semesan was second in the two year average with 127 pounds increase. Corona Merco has been a leader in past years. This work seems very promising and the table is submitted above for those interested.

Boll Weevil and Plant Lice Control Work—These insects were not present in sufficient numbers to conduct a test of this nature this year and the plats where this work was carried on, each produced about the same amount of seed cotton per acre. There is no doubt but that poisoning cotton pays as our past records bear out this fact.

Cotton Following Winter Legumes—The purpose of this test is to determine how much nitrogen is stored in the soil by various winter legumes. As the table shows, some of the plats are left bare during the winter and commercial nitrogens are applied. All plats received an 0-8-4 fertilizer and the commercial nitrogen is added to the check plats.

The legumes were turned about the middle of April, fertilizer applied April 30th and the four series planted to Lone Star-168 on May 1, 1930. Plats consist of five rows, each 125 feet long, and between each plat is one blank row. Below may be seen the results of this test as listed in table 10:

TABLE 10—WINTER LEGUMES AND COTTON TEST—1930

Legume Cover Crop	Fertilizer Used 600 lbs. per Acre	Yield per Acre in lbs. Seed Cotton	2 Year Average 1929-30
None	6-8-4	1368	1394
Hairy Vetch	0-8-4	1439	1286
Monantha Vetch	0-8-4	1258	1262
None	0-8-4	1207	1134
None	6-8-4	1665	1632
Bur Clover	0-8-4	1165	1063
Crimson Clover	0-8-4	1069	1002
Austrian Peas	0-8-4	1027	1024
None	6-8-4	1368	1313

CORN

Very few Mississippi farmers make enough corn to properly feed their livestock throughout the year. If food for the home and feed for the livestock were raised and then the balance of the time devoted to growing cotton then there is no doubt but that a better price could be secured for cotton. In the past, practically all farm accounts were secured by so many bales of cotton, but today bankers are eager to advance money to reliable parties on pure bred livestock, especially for dairying purposes. A few good cows quickly grow into a profit producing herd and a herd of cattle call for corn and legumes for feed. Growing legumes in every row of corn should be practiced on every farm as there is no better soil builder at a cheaper price. Six or seven pounds of laredo or ottotan soybeans will plant an acre when planted in the row with the corn. A crop of this nature will make an excellent fall pasture after the corn has been harvested. The plan of working and hoeing early corn and soybeans while waiting for cotton to get large enough to chop would certainly help remedy the feed situation.

The work at this station includes variety tests, fertilizer analysis tests,

nitrogen sources test and corn and soybean tests.

Below may be seen table 11 which gives the results of twenty-one leading varieties of corn planted in four series May, 1930. Four hundred pounds per acre of a 4-8-4 fertilizer were applied before planting and when the corn was about twenty inches high, it was hoed and given a side dressing of 200 pounds of nitrate of soda per acre. This test was planted in three foot checks on three and one-half foot rows, each 125 feet in length.

TABLE 11—VARIETY CORN TEST—1930

Variety	Yield in Bushels Shelled corn Per Acre	Percentage of Grain	Rank 1930	Average Yield in Bushels 1922-1930	Rank 1922-1930
Mosby-Station	25.7	76.67	17	36.9	7
Mosby-Delta	27.7	76.56	16	40.1	4
Mosby-D. & P. L.	30.9	77.00	13		
Mosby-Suttle	28.0	80.39	15		
Mosby-Cork	23.7	78.11	21		
Mosby-Calhoun-1-Wood	24.4	81.61	19		
Mosby-Calhoun-2-Sta.	25.6	79.72	18		
Cocke's Prolific	31.6	80.56	11	40.6	2
Hastings	31.1	79.11	12	37.9	6
Jellicorse	33.5	77.47	6		
College-47	39.4	79.56	1		
Laguna	32.1	75.00	9	42.4	1
Mexican June	36.9	75.94	3	38.3	5
Paymaster	37.0	82.47	2	40.6	2
Yellow-Dent-Ferg.	33.2	80.86	7		
College-Y-4	35.7	79.94	4		
Golden Dent-R. H.	29.1	77.47	14		
College-G-4	33.1	75.56	8		
Jarvis	31.8	77.50	10		
Matheney	24.3	79.50	20		
Cocke's Pro-Ray.	33.9	80.83	5		

Remarks—In this test we used 200 pounds of nitrate of soda per acre this year. In the above table the 1930 results will be found in the first three columns of figures. The fourth column shows the nine year average yield of eight varieties, while the last column shows the rank of these varieties for nine years.

The leading variety for the past two years is College-47 with a 1930 production of 39.4 bushels of shelled corn per acre. This is 15.7 bushels more than the trailing variety produced. Last year, this same variety led with a production of 81.8 bushels the first time it was tested. Laguna leads the nine year average with 42.4 bushels per acre. Cocke's Prolific and Paymaster tied for second place in the nine year average with 40.6 bushels per acre.

The Mosby varieties are subject to weevil damage in this section if planted early. Cocke's Prolific, Laguna, Paymaster, College-47 and Hastings are all good varieties to grow. For late plantings, use Mexican June. Extreme care should be exercised in the source from which seed corn is purchased. Every farmer should select seed corn in the field and very probably a superior grade of seed could be secured to that offered by some markets.

TABLE 12—CORN FORMULA TEST—1930

POUNDS OF MATERIAL APPLIED PER ACRE			BUS. EAR CORN PER ACRE			
Nitrate of Soda	Super-phosphate	Muriate of Potash	Plat Yield	Check Yield	Increase 1930	2-Year Average Increase
200			25.0	25.0		
200	100		24.5	26.5	-2.0	-1.4
200	100	50	24.9	28.0	-3.1	-3.2
200		50	30.9	29.5	.4	-.8
200			30.9	30.9		
			20.1	30.5	-10.4	-11.0
200	200		27.5	30.2	-2.7	.9
200	200	50	31.8	29.8	2.0	2.5
200			29.5	29.5		

Remarks—In this test we used 200 pounds of nitrate of soda per acre as a check, for this element of plant food is certainly essential in the successful production of corn. One plat in each series is left unfertilized and all except the checks vary with the addition of phosphorus and potash.

This test was fertilized May 13 and planted in four series to Cocke's Prolific corn on May 15, 1930. Plats consist of five rows, each 125 feet long. A good stand was secured. It is interesting to note that the unfertilized plats produced 10.4 bushels less than the plats receiving 200 pounds of nitrate of soda per acre. Two hundred pounds of superphosphate and fifty pounds of muriate of potash added to the 200 pounds of nitrate of soda increased the total yield two bushels per acre. Fifty pounds of muriate of potash added to the nitrate gave an increase of four-tenths bushels. Superphosphate, when added alone, failed to register an increase.

For general use in fertilizing corn, a mixture of 100 pounds of superphosphate, 150 pounds of nitrate of soda, calcium nitrate or their equivalent in pounds of nitrogen and 50 pounds of muriate of potash per acre will give good results. Any form of potash may be used, where good farming and frequent cultivation is to be done, then a side-dressing of 50 to 100 pounds of some quick acting form of nitrogen might be profitably used. Apply the side dressing when the corn is about twenty inches tall.

TABLE 13—CORN NITROGEN SOURCES—1930

Material Used 30 lbs. Nitrogen per acre	BUSHELS EAR CORN PER ACRE Plat Yield	Check Yield	Bushels Increase	PER CENT INCREASE 1930	5-Year Average
No Nitrogen	16.0	16.0			
Nitrate of Soda	28.9	17.2	11.7	68.0	70.9
Ammonium Sulfate	27.0	18.4	8.6	46.7	39.3
Leunasalpeter	27.3	19.6	7.7	39.3	45.9
No Nitrogen	20.8	20.8			
Calcium Cyanamid	30.1	19.9	10.2	51.3	44.7
Calcium Nitrate	30.1	19.1	11.0	57.6	66.9
Urea	28.9	18.2	10.7	58.8	59.2
No Nitrogen	17.4	17.4			

NOTE: All plats including checks received 300 pounds superphosphate and 200 pounds Kainit per acre.

Remarks—Some of the leading sources of nitrogen have been tested under corn on this station for five years. The last column of figures in table 13, represents a five year average with corn, showing the percentage of increase over the check or plats fertilized with 300 pounds of superphosphate and 200 pounds of kainit per acre. All these percentages indicate that nitrogen is very necessary.

The fertilizer was applied to this test May 29, and Cocke's Prolific corn planted in four series on June 5, 1930. Good stands were secured. Plats consist of five rows, each 125 feet long. Records were taken from the three inside rows.

Nitrate of soda leads the 1930 test, closely followed by calcium nitrate, urea and calcium cyanamid. The five year average is also headed by nitrate of soda, with calcium nitrate and urea closely following. Nitrogen pays better dividends with corn than any other of the fertilizers in this section.

TABLE 14—CORN, SOYBEANS AND PEAS "AT LAY-BY" TEST—1930

Method of Planting	BUS. OF EAR CORN PER ACRE Plat Yield	Check Yield	Increase 1930	2-Year Average 1929-30
Corn, alone	27.13	27.13		
Corn, with soybeans	56.60	27.47	29.13	11.12
Corn, with peas at lay-by	52.96	27.81	25.15	12.18
Corn, alone	28.15	28.15		

Remarks—Many inquiries come to us as to how much reduction in yield of corn per acre can be attributed to the growth of soybeans planted in the

corn rows or by planting peas in the middles at the "lay-by" cultivation. This test was planted in four series June 2, 1930. In fairness to the soybeans, it must be stated that dry weather kept the late planted peas from growing very much. In 1929, there was a reduction of 6.9 bushels of corn per acre where soybeans were planted with the corn. The 1930 results show an increase of 29.13 bushels where the beans were planted in the corn. This can very probably be attributed to the fact that for the past two years, the soybeans have stored nitrogen on these plats, and too, the plant was turned under on the plat. The two year average increase was 11.12 bushels for the soybeans and 12.18 for the peas. Besides building up the soil, soybeans make a valuable feed and constitute an additional crop without extra expense as the corn must be cultivated anyway. By all means, Mississippi farmers should grow soybeans in every row of corn. Harvesting soybeans in corn is best accomplished by turning livestock in the fields after the corn is harvested.

Soybeans—Every farmer in this state should grow enough soybeans to supply at least the hay needed for the livestock on the farm; for this crop has a three-fold value due to the fact that it constitutes a safe feed crop, makes hay with a high grain content and improves the soil. Stock can be carried over the winter on good soybean hay and some farmers have been known to make a crop while feeding this hay alone. Every field that begins to fall off in production should be planted to beans or peas and allowed to come back to normal.

Early corn planted to otootan or goshen soybeans may be harvested in early September and stock can be turned in on the beans which are just in the blooming stage, furnishing plenty of good green feed while other pastures are short or dry. This is a plan that is especially adapted to the dairy farmer. On the other hand, these beans could be cut for hay or saved for seed after the corn is harvested.

Below may be seen the tabulated results of the soybean variety test for comparative yields of hay and grain:

TABLE 15—SOYBEAN VARIETY TEST FOR HAY AND GRAIN YIELD—1930

	HAY					GRAIN			
			RANK						Average
Variety	Date of Cutting	Tons per acre Yield	1930	Average 1928 9-30		Date of cutting	Bus. per acre Yield	Rank 1930	1928 1929 1930
Geo. Washington	9-3-30	3.07	11	5		9-30-30	26.65	6	4
Delta-488-607	9-9-30	3.66	7	7		10-6-30	26.68	1	3
Delta-6114	9-22-30	3.37	10			10-21-30	25.48	8	
Laredo	9-22-30	3.95	6	3		10-14-30	25.28	4	2
Mammoth Yellow	9-22-30	3.51	8	6		10-20-30	26.48	7	1
Tar Heel Black	9-22-30	4.86	4			10-20-30	23.92	2	
Lexington	9-3-30	3.44	9			9-26-30	14.50	13	
Delta-5405	9-9-30	2.56	14			10-6-30	18.68	9	
Ebony	9-3-30	3.07	11			9-26-30	11.98	14	
U. S. D. A.-04925	10-8-30	4.68	5			11-3-30	16.49	11	
Delta-6115	9-22-30	2.12	15			11-4-30	10.73	15	
Otootan	10-9-30	5.64	2	4		11-18-30	22.36	5	5
Tanloxi	10-9-30	5.49	3	1		11-4-30	20.35	8	6
Biloxi	10-9-30	6.09	1	2		11-4-30	17.95	10	7
U. S. D. A.-33906- Sta.	9-9-30	2.85	13			10-6-30	15.46	12	

Remarks—The field where this test was conducted was fertilized with 200 pounds of a 4-8-4 per acre and planted May 30, 1930, after turning under a crop of crimson clover three weeks before. Soybeans may be safely planted from March 25 to July 15, but the earlier the planting, usually the larger the yields, as the plant has more time to develop. Maturity dates of the varieties remain more or less the same regardless of when planted. For other varieties, we might say that the margin of difference in the dates

of maturity are not nearly so great as the margin of difference in the dates of planting.

Soybeans should be cut for hay when the top pods are well formed. This is the good dough stage which makes the hay palatible and of high digestible nutrient content. The leaves will not shed much at this time.

In saving grain, cut when one-half to three-fourths of the leaves have shed, or on the other hand, when three-fourths to four-fifths of the pods have lost their green color. Saving beans for seed on the poorer types of soil especially, is a good practice as the bean plants will improve the soil. If soybean harvesters are to be used the plants should be permitted to fully mature. On thin land, soybeans should be planted on three foot rows and fertilized with 200 pounds of superphosphate per acre. Where soybeans have never been grown before, the seed should be inoculated to get the best results from a soil improvement standpoint, as well as yields.

A careful study of the harvest dates and yields, in the above table, will be beneficial to those planning to grow this crop. For instance, a schedule of varieties that mature in succession from early to late might be desired such as this one: Midwest or Lexington, George Washington, Delta-488, Laredo, Tanloxi or Biloxi and Otootan. Again we emphasize the importance of growing soybeans in every row of corn grown in Mississippi.

Forage Crops—Due to the drought this past summer, many calls came to the station in July from farmers who realized they would lose their corn crop and hay crop and be without feed this fall. It was suggested to them to break their tomato and truck lands and plant George Washington soybeans mixed with sagrain in the drill on three foot rows. If no truck lands were available then use 200 pounds 4-8-4 fertilizer per acre before planting the above plant crop. Reports from fifty or sixty of these farmers were to the effect that this crop made them plenty of feed for the winter.

A new forage and grain crop grown on the station this year for the first time called "Grohoma" attracted quite a bit of attention. It has the appearance and qualities of the shrocks. The leaf is slightly broader and the grain somewhat larger than orange sorghum. It was developed in Oklahoma and given to us by a local friend, Mr. P. D. Ratliff. Grohoma and soybeans planted together would also make a good forage crop that would be easy to produce.

Alfalfa—Lime is necessary for the growth of alfalfa. On our non-lime lands, four tons of crushed limestone per acre must be applied every three or four years to grow this crop. There are two fields of alfalfa that were planted last October now growing luxuriantly on the station. One field was limed five years ago and the other two years ago. Fertilizer work with this crop favors phosphorus and nitrogen, respectively. The first cuttings here are always good, but unless a weeder is run over the patch just after mowing, then the second cutting will be about half crab grass. A couple of acres in this crop near the barn furnishes nice winter grazing for poultry and young stock and the hay comes in well on the ration for other stock, but as a commercial proposition, alfalfa will never be successfully grown on our non-lime lands. Alfalfa should always be planted on wel drained soils catering to the clays more or less.

Oats and Wheat—The oat test was not planted during the fall of 1929 due to continued rains and wet land. In the spring of 1930, a test was planted late and the drought ruined all results that might have been obtained. Our wheat suffered a like fate. All oats on the station last winter were killed by the excessive cold. Oats and wheat this year look very promising at present. Rust proof and Norton's are favorites here. The Norton is

cold resistant to a certain extent. Blue Stem and Red May wheats are popular, but very little wheat is planted in this section on account of a lack of milling facilities.

HORTICULTURE

Due to the close proximity of the world famous "Crystal Springs-Utica-Hazlehurst" trucking section, it has befallen the lot of this station to do quite a bit of trucking work. The supremacy of the tomato as the leading truck crop naturally demands that it receive the major attention. Variety and fertilizer tests were also conducted with English Peas and snap beans. Fruits also received attention which will be discussed under the head of orchards.

Many of the tables listed herein will give averages for a period of years. Results of this nature are much more reliable than the results of one year. All tomatoes were harvested in the "green wrap" stage of ripeness. All rows were three and one-half feet wide and all plants set two feet in the drill. When the fertilizer listed as the "combination" is used it means that the nitrogen is derived by using equal pounds of nitrogen from each of nitrate of soda, ammonium sulphate and cottonseed meal.

Below may be seen the tomato variety test for 1930. Twenty-three leading varieties and strains are listed in table 16:

TABLE 16—TOMATO VARIETY TEST—1930

	YIELD IN LBS. PER ACRE		PER CENT	PER CENT PICKED EARLY		AVERAGE SIZE OF SHIPPERS	4-YR. AV. PER CENT
Variety	Total	Shippers	Shippers	Total	Shippers	In Lbs.	Shippers
Globe-Livingston L&H	16187	12282	75.9	46.1	50.3	.284	65.5
Globe-Rice L&H	12363	9646	78.0	38.6	44.4	.260	
Globe-Kilgore	9234	6215	67.3	26.6	32.4	.255	
Globe-Livingston-Reuter	14964	10854	71.5	47.1	56.6	.270	
Gulf States-Rice	10583	7299	69.0	34.9	43.5	.234	
Gulf States-Reuter	14391	10166	70.6	47.4	59.1	.252	67.3
Detroit-Ferry	9934	6616	66.6	41.6	53.2	.241	64.5
Marglobe-Rice	15513	12442	80.2	45.4	51.2	.293	
Marglobe-Kilgore	9896	7789	78.7	26.8	29.6	.255	
Marglobe-S. Str. Pritchard	13067	10312	78.9	40.8	48.1	.237	
Marglobe-Reuter	16612	12570	75.7	54.1	59.6	.290	66.7
Marvel-Livingston	11128	7310	65.7	51.9	62.5	.239	64.9
Norton-Pritchard	18417	13685	74.3	62.2	68.1	.263	65.5
Norton-Reuter	13914	9795	70.4	60.3	68.4	.252	
Coopers Sp. Rich-Rice	11721	7131	60.8	50.2	61.7	.226	61.5
Royal Purple-Rice	8679	6290	72.5	63.5	72.4	.269	
Crystal Sp. Mk.-Rice	14345	10683	75.2	67.5	73.0	.252	70.3
Marvana-Pritchard	14354	9528	66.4	58.8	73.8	.222	
La. Pink-Reuter	17102	11897	69.7	56.8	65.9	.229	63.6
La. Red-Reuter	15215	9882	64.9	53.7	68.0	.250	62.1
Foster-Foster	12133	8164	67.3	74.6	87.4	.243	63.9
Taylor-Taylor	16687	12678	76.0	66.8	77.5	.274	
Special-Kilgore	15666	11175	71.3	60.5	70.1	.241	

Remarks—Leading varieties and strains of tomatoes were selected for this test. Many of these varieties are common in the trucking section. The seeds were planted in the hot bed January 20 and transplanted to the cold frames around March 1st and on April 17th were set on the plats. Ideal transplanting weather prevailed and good stands were secured. Wet lands prevented going to the field earlier. The test was in two series, the plants staked and trained to a single stem. Fertilizer was applied at the rate of 1500 pounds per acre of a 4-8-4 combination analysis on April 14, 1930. The fruit was harvested in the 'green wrap" stage of ripeness.

Results—Pritchard's Norton led the test with 13,685 pounds of shippers per acre. The Taylor, Marglobe by Reuter, Marglobe by Rice, Livingston's

Globe, and Louisiana Pink, respectively, were next in yield of shippers per acre. The Taylor was used in the test for the first time this year. It is the product of a local Crystal Springs grower.

Rice's Marglobe, Reuter's Marglobe, Livingston's Globe and the Taylor varieties, respectively, produced the average largest sized marketable fruit. Marglobe by Rice, Pritchard and Kilgore, respectively, Globe by Rice and Taylor produced the highest per centage of marketable fruit and thus the smaller yields of cull fruit.

The four year average per cent of shippers is led by Crystal Springs Market, Gulf States, Marglobe and Norton respectively.

Never have our test work turned out a more beautiful crop of fruit from a quality standpoint. There was practically no insect damage, very little rot, no "cat-faces" and only traces of mosaic here and there. In line with this, we might say that never have prices been more disappointing.

TABLE 17--FERTILIZER ANALYSIS TEST WITH TOMATOES
(Average for 1926-27-28-29 and 30)

	YIELD IN POUNDS PER ACRE		PER CENT	PER CENT PICKED EARLY		DOLLARS PER ACRE		
Analysis	Total	Shippers	Shippers	Total	Shippers	Value @ 6c lb.	Cost of Fert.	Net Profit
	(1500 pounds per acre)							
3-10-3	13425	8253	60.4	43.8	44.3	$495.20	$19.74	$475.46
3-10-3-L	14716	10258	68.8	40.9	40.7	615.47	25.50	589.97
3-8-3	14246	9558	65.7	45.9	43.6	573.49	18.05	555.44
4-8-4	14387	9376	64.9	47.3	44.5	562.45	21.38	541.16
5-8-3	14631	10491	71.3	48.5	68.4	629.47	23.96	605.51
	(2000 pounds per acre)							
3-10-3	16012	11243	68.3	50.8	46.2	674.57	26.32	648.25
3-10-3-L	15142	9891	64.3	44.5	43.1	592.27	34.00	578.27
3-8-3	14598	9655	65.3	45.3	44.9	579.31	27.04	555.24
4-8-4	13156	8802	65.0	46.4	43.8	528.14	28.51	499.63
5-8-3	15156	10751	69.0	44.9	46.1	645.05	31.95	613.10

NOTE: The 3-10-3 marked L is a commercial mixture while the other 3-10-3 was home mixed.

Remarks—This test was conducted to determine the most economical fertilizer analysis for producing tomatoes commercially. The test was conducted in two series. Plants of the Marglobe variety were set two feet apart in rows three and one-half feet wide, staked and trained to a single stem. The plants were topped with four clusters of fruit and the fruit was harvested in the "green wrap" stage of ripeness.

The fertilizer analysis tested were as listed in the above table. The analysis market 3-10-3-L was a factory product and most of the nitrogen was derived from castor pumace. This product is used extensively in the Crystal Springs trucking section. The other 3-10-3 was a home-mixed product using the combination nitrogen, superphosphate and muriate of potash.

Results—The above table represents average results for the past five years. In the 1500 pound applications, the 5-8-3 produced the largest yield and the higest net profit per acre. In the 2000 pound applications, the 3-10-3 roduced the largest yield of marketable fruit and the highest net profit per acre. The 5-8-3 was a close second. The five year average holds good for the 1930 crop also. These results indicate that the best analysis to use on the 1500 pound per acre basis would be a 5-8-3, while the 3-10-3 may be used to an advantage when 2000 pounds per acre are used in producing a commercial crop.

TABLE 18—AVERAGE RESULTS OF POTASH TEST WITH TOMATOES
(1924-25-26-27-28-29 and 30)

Analysis	YIELD IN POUNDS PER ACRE		PER CENT	PER CENT PICKED EARLY		DOLLARS PER ACRE		
	Total	Shippers	Shippers	Total	Shippers	Value @ 6c lb.	Cost of Fert.	Net Profit
(1500 pound application per acre)								
4-8-0	13981	8568	58.2	46.4	53.2	$516.59	$10.44	$505.30
4-8-8	14303	8821	59.3	46.7	49.1	529.26	20.34	497.57
4-8-8	15201	8458	53.4	48.3	52.3	507.45	13.56	495.17
(1500 pound application per acre)								
4-8-0	14719	8597	55.2	45.8	52.8	515.80	15.66	500.14
4-8-4	13700	8147	56.5	50.6	50.4	488.84	18.78	470.06
4-8-4	14303	8821	59.3	46.7	49.1	529.26	20.34	508.70
(2000 pound application per acre)								
4-8-0	14408	8437	54.7	44.7	44.4	506.33	20.88	485.34
4-8-4	14484	8677	55.4	48.2	51.4	520.59	25.04	495.55
4-8-8	13251	7692	56.7	40.0	41.1	461.53	27.12	434.11

Remarks—This test was conducted in two series to determine the most economical amount of potash to use in a fertilizer formula for producing tomatoes commercially. Plants of the Marglobe variety were used and handled in a manner described in the other tests. The potassium was derived from muriate of potash, the phosphoric acid from superphosphate and the nitrogen was derived from the above described combination.

Results—The above table represents an average over the past seven years. The 1500 pound application favors the eight per cent potash, the 2000 pound application favors four while the 1000 pound application states that no potash is necessary. The 1930 results are responsible for this as practically all rates of application favored no potash more or less. It is our opinion that the drought held some of these elements in check and only a certain part was utilized. For this reason, we feel safe in recommending four per cent potash in a formula on average soils used for tomatoes, believing this will enable the plants to make better use of the nitrogen and phosphorus plant foods. From observation a more stockily built plant and better colored fruit results from the use of potash in a tomato fertilizer.

TABLE 19—AVERAGE RESULTS OF NITROGEN SOURCE TEST WITH TOMATOES
(1924-25-26-27-28-29 and 30)

Nitrogen Sources	YIELD IN LBS. PER ACRE		Per Cent	PERCENT PICKED EARLY		Total Money	
	Total	Shippers	Shippers	Total	Shippers	Value	Rank
(1500 pound application of a 4-8-4 per acre)							
Nitrate of Soda	11882	7184	55.9	46.7	52.3	$431.88	2
Ammo. Sulphate	11169	6745	56.8	53.3	53.7	404.69	4
Combination	11265	7017	59.1	47.9	48.8	421.05	3
Cottonseed Meal	12362	7797	58.9	46.5	46.9	467.82	1
Calurea	10096	6032	57.1	49.3	53.4	346.49	5
(2000 pound application of a 4-8-4 per acre)							
Nitrate of Soda	11685	7019	57.6	47.0	49.8	421.11	3
Ammo. Sulphate	11620	6965	58.0	52.4	54.2	417.89	4
Combination	12351	7175	56.4	46.5	48.2	430.51	2
Cottonseed Meal	12424	7681	58.9	43.8	45.9	460.85	1
Calurea	11373	6801	58.1	51.6	55.4	408.07	5

NOTE: Calurea was substituted for Urea in 1930.

Remarks—This test was conducted to determine the best source of nitrogen to use in a complete fertilizer formula for producing tomatoes commercially. Plants of the Marglobe variety, set and handled as in the other tests, were planted in two series April 17, 1930.

Results—The above table represents a seven year average. Cottonseed meal leads the 1500 and the 2000 pound applications with a total money value of $467.82 and $460.85 per acre, respectively. Nitrate of soda was second in the 1500 pound application and the combination second in the 2000

pound application. Nitrate of soda was third in this latter application. The present price of cottonseed meal should make it an interesting source of nitrogen for the trucker this year. In former years, the price has been prohibitive to most truckers. A careful study of the above table will prove very interesting to tomato growers.

TABLE 20—NITROGEN SOURCES TEST WITH TOMATOES—1929 AND 1930

Nitrogen Sources	LBS. PER ACRE Total	Ship-pers	Per Cent Ship-pers	Per Cent picked early Total	Ship-pers	DOLLARS PER ACRE Value @ 6c lb.	Cost of Fert.	Net Gain	Size of Fruit
(Nitrogen sources test in a 1500 pound application of a 4-8-4 analysis)									
Nitrate of Soda	15923	10960	69.6	49.7	51.1	$657.47	20.64	636.93	.238
Ammo. Sulphate	16150	11841	73.3	55.3	54.2	710.43	19.08	691.35	.289
Cottonseed Meal	18193	13704	74.7	46.9	48.7	822.21	31.44	790.77	.286
Combination	14700	10460	72.5	46.9	46.9	627.60	23.60	604.00	.285
1-2 Ni. Soda and 1-2 C. S. Meal	14702	10477	72.4	43.3	42.1	628.59	25.86	602.73	.280
1-2 Ammo. Sulp. and 1-2 C. S. Meal	14828	10648	73.8	52.6	52.66	638.88	25.26	613.62	.269
Calcium Nitrate	16272	12062	74.1	47.7	46.8	723.72	20.64	703.08	.283
Calurea	14584	10391	72.1	49.1	50.2	623.46	16.68	606.78	.284
(Nitrogen sources test ina 2000 pound application of a 4-8-4 analysis)									
Nitrate of Soda	14963	10461	70.2	43.3	42.4	622.68	27.52	601.01	.283
Ammo. Sulphate	15222	10708	71.1	50.7	50.0	642.48	25.44	617.04	.286
Cottonseed Meal	16716	12234	73.4	34.8	33.2	734.04	41.92	692.17	.291
Combination	15501	11045	71.9	41.5	37.9	662.67	31.87	631.00	.300
1-2 Ni. Soda and 1-2 C. S. Meal	15316	11063	72.5	45.3	46.7	663.28	34.48	479.30	.284
1-2 Amm. Sulphate and 1-2 C. S. Meal	17687	12747	71.8	42.7	42.0	764.82	33.68	731.14	.284
Calcium Nitrate	16021	11986	75.5	44.2	43.2	719.16	27.52	691.64	.278
Calurea	15158	10891	72.6	50.1	50.4	653.46	22.24	631.22	.289

Remarks—A new nitrogen sources test with tomato fertilizers was started in 1929. The above table 20 shows an average for the past two years. The Marglobe variety used and planted in two series April 17, 1930. Good stands were secured.

Results—The two year average in the 1500 pound applications gives the lead to cottonseed meal with a net gain of $790.77 per acre. Ammonium sulphate is second and nitrate of soda takes third place. In the 2000 pound application, the mixture, half ammonium sulphate and half cottonseed meal takes the lead with a net gain per acre of $731.14. Cottonseed meal is second and calcium nitrate comes third.

In the 1000 pound application, ammonium sulphate produced the average largest fruit, but in the 2000 pound application the combination took this honor with an average size of three-tenths pound per fruit.

TABLE 21—AVERAGE RESULTS OF FERTILIZER ANALYSIS TEST WITH ENGLISH PEAS (1924-25-26-27-28-29 and 30)

Analyses	Yield in lbs. per acre	DOLLARS PER ACRE Value @ 5c a lb.	Cost of Fert.	Net profit	Seven yr. average rank	1930 yield per acre
(1000 pound application per acre)						
3-10-3	3309	$165.45	$11.59	$153.86	1	3696
4-8-4	3014	150.70	12.52	138.18	3	3398
6-8-4	1664	83.20	16.80	66.40		2798
4-8-0	2055	102.75	10.44	92.41		3558
(1500 pound application per acre)						
3-10-3	3201	160.05	17.39	142.66	2	3902
4-8-4	3106	155.30	18.78	136.52	4	3603
6-8-4	1876	93.80	25.20	68.60		3259
4-8-0	2071	104.05	15.66	88.39		3665

NOTE: The analysis 6-8-4 and 4-8-0 were tested in 1929 and 30 only.

Remarks—This test was conducted to determine the most economical fertilizer analysis for producing the commercial pea crop. The test was planted March 5, 1930 to the Gradus variety in two series. Combination nitro-

gen was used in these formulae. A good stand was secured. Visitors marvelled at the way these peas stood the dry weather that was in progress in April and the first half of May.

Results—The above table represents results for a period of seven years with the exception of the 6-8-4 and the 4-8-0 analysis. The 3-10-3 produced larger net profits per acre in both the 1000 and 1500 pound applications, with the 1000 pound application in the lead with a net profit of $153.86 per acre. In 1930, the 1500 pound application of 3-10-3 produced 3902 pounds of peas per acre and the 1000 pound application produced 3696 pounds per acre. We recommend a 3-10-3 fertilizer at the rate of 1000 pounds per acre for English peas.

TABLE 22—AVERAGE RESULTS OF NITROGEN SOURCES TEST WITH ENGLISH PEAS
(1924-25-26-27-28-29 and 30)

Nitrogen Sources	Yield in lbs. per acre	Seven Year average	Rank	1930 yield per acre	1930 Rank
	(1000 pounds per acre of a 4-8-4)				
Nitrate of Soda	3640	2		3425	3
Ammonium Sulphate	3695	1		3974	2
Combination	3002	6		3501	4
Leunasalpeter	2069			3568	5
	(1500 pounds per acre of a 4-8-4)				
Nitrate of Soda	3512	3		3434	7
Ammonium Sulphate	3503	4		3898	3
Combination	3229	5		3820	4
Leunasalpeter	2421			4226	1

NOTE: The Leunasalpeter was tested during 1929 and 1930 only.

Remarks—This test was conducted to determine the most economical source of nitrogen for producing the commercial pea crop. The Gradus variety planted March 5, 1930 in two series. The sources used are as stated in the above table 22. Leunasalpeter has only been tested for the past two years. The 4-8-4 formula was used exclusively.

Results—Ammonium sulphate in the 1000 pound application led the seven year average with 3696 pounds of peas per acre. Chilean nitrate of soda, the usual leader, comes second with 3640 pounds of peas per acre. Leunasalpeter led the 1929 and 1930 tests, producing in 1930 in the 1500 pound application 4226 pounds of peas per acre. Either of these three nitrogens named could easily be recommended, but ammonium sulphate has a slight advantage.

English Pea Variety Test—The variety test with English peas gave the following results: Thomas Laxton, 4694; Excelsior, 3919; Gradus, 3516 and Alaska, 2643 pounds of green peas per acre. Most growers in this section prefer the Thomas Laxton. It is very prolific and the large, well formed pods fill a hamper quickly. The test was conducted in three series.

TABLE 23—AVERAGE RESULTS OF FERTILIZER ANALYSIS TEST WITH SNAP BEANS

Analysis	Yield per acre in lbs.	DOLLARS PER ACRE Value @ 5c	Cost of Fertilizer	Net Profit	Seven yr. average rank	Yield per acre 1930
		(1000 pound application per acre)				
3-10-3	3647	$182.35	$11.59	$170.76	2	2774
4-8-4	3691	184.55	12.52	172.03	1	4093
6-8-4	4725	236.25	16.80	219.45		3632
4-8-0	4492	224.60	10.44	214.16		4427
		(1500 pound application per acre)				
3-10-3	4118	205.90	17.39	188.51	2	3389
4-8-4	4161	208.05	18.78	189.27	1	3272
6-8-4	6090	304.50	25.20	279.30		2195
4-8-0	5440	272.00	15.66	156.34		2479

NOTE: The analysis 6-8-4 and 4-8-0 were tested during 1929 and 30 only.

Remarks—This test was conducted to determine the most economical fertilizer analysis for producing the commercial crop of snap beans. Burpee's Stringless green pod was planted in two series April 11, 1930. The 6-8-4 and the 4-8-0 analysis were tested only during 1929 and 1930. A good stand was secured.

Results—The seven year average favors the 4-8-4 in both the 1000 and 1500 pound applications with respective net gains of $172.03 and $189.27.

The 1000 pound 4-8-4 application led in 1930 with a production of 4093 pounds of beans per acre, and the 1000 pound 6-8-4 was second with 3632 pounds. By the 6-8-4 making such a good showing, then it would appear that beans need more nitrogen than English peas, certainly a 4-8-4 at least.

TABLE 24—AVERAGE RESULTS OF NITROGEN SOURCES TEST WITH SNAP BEANS (1924-25-26-27-28-29 and 30)

Nitrogen Sources	Yield per acre in pounds	Seven Year Average rank	1930 Yield per acre	1930 Rank
(1000 pound application per acre of a 4-8-4)				
Nitrate of Soda	3882	3	3578	3
Ammonium Sulphate	3923	2	3902	2
Combination	3662	4	3504	4
Calurea	4713	1	4179	1
(1500 pound application per acre of a 4-8-4)				
Nitrate of Soda	3805	2	1640	7
Ammonium Sulphate	3532	4	1632	8
Combination	3680	3	2108	6
Calurea	4535	1	2870	5

NOTE: Calurea was substituted for Urea the last two years.

Remarks—The object of this test is to determine the most economical source of nitrogen to use in the commercial production of snap beans. The sources were tested in a 1000 and 1500 pound application of 4-8-4 per acre. Calurea was substituted for urea during the last two years. The test was planted to Burpee's Stringless green pod in two series on April 11, 1930.

Results—The seven year average as well as the 1930 results of the 1000 pound application per acre gives calurea the lead with a production of 4713 and 4179 pounds of beans per acre respectively. Ammonium sulphate was second with 3923 and 3902 pounds of beans per acre. Calurea also led the 1500 pound application with a yield of 4535 pounds of beans per acre. It would appear that 1000 pounds of fertilizer per acre using calurea or ammonium sulphate could be recommended.

Snap Bean Variety Test—This test was planted April 11, 1930 to three series with the following results: Burpee's Stringless, 5030; Reuter's Red Valentine, 4275; Prolific Black Wax, 2515 and Refugee or 1000 to 1 produced 1033 pounds of beans per acre. The Giant Stringless, Yellow Wax and Valentine are the three leading varieties grown in the trucking section.

GENERAL WORK

Rotations—Crop rotation should be practiced by every farmer in the state. It is our policy to grow a legume on all lands at least once a year. The poorer fields and all corn lands grow legumes twice a year. Most of our lands on the station at the present are growing winter legumes of some kind, either alone or planted with oats or rye. Several rotations are under way and outstanding among these is the two year rotation with cotton, vetch and rye or oats, corn and soybeans. This means that two crops are grown on the land every year and one of these crops is a soil builder the first year and the second year two soil builders are grown, one in the winter and the other with the corn in the summer.

To begin this rotation, sow broadcast twenty pounds of hairy vetch seed mixed with a bushel of abruzzi rye or one and one-half bushels of oats at the last cultivation of the cotton. This statement is not made for those who "lay-by" cotton by July 4, but for the real cotton farmer that cultivates up to the time cotton is nearly ready to open. This vetch or vetch with rye or oats will germinate in the fall and mature seed around the first of June when the entire crop should be turned under to insure a volunteer crop the following fall. After turning under, plant the land to corn and soybeans. As stated, the vetch volunteers and in the spring may be turned under or cut for hay as desired and then the land planted to cotton. It is advisable to turn the vetch under as the green crop is very valuable in nitrogen content. Permit vetch to mature seed every other year and be insured of a volunteer stand every year. Our policy is to turn under the vetch every year before the seed are mature for the reason that more nitrogen and

humus are stored in the soil than the money value involved in the purchase of the seed each year. In other words, it pays so well when turned under we can afford to purchase new seed each year. Bur clover may be used in the place of vetch on good soils if desired as it will also reseed. Austrian winter peas may be used but must be planted each year.

Vetch has been grown on very poor gray land on the station and has about trebled the yield of soybeans on this land. However, it should be borne in mind that vetch like any other crop does better on good land, so to be successful, plant it on your best acres first and give it a chance. Many farmers make a failure with vetch because they plant it on the poorest soil available, where nothing else will grow. Give vetch a chance.

Where vetch is to be grazed a little during the winter and later cut for hay, it is advisable to plant oats with it in order that the mower may cut it easily. If for grazing and turning under, use rye with vetch as rye does not winter kill. A bushel of rye and twenty pounds of vetch is a good seeding for an acre and one and one-half to two bushels of oats with twenty pounds of vetch is a splendid seeding per acre. Thirty pounds of Austrian winter peas with rye or oats is also a mixture well recommended.

Legumes—There are two classes of legumes, winter and summer. Much benefit has been derived from using bur clover, vetch, Austrian winter peas and crimson clover as winter legumes. Vetch and bur clover are the only ones that can be depended upon to reseed from a crop turned under. The Austrian winter peas germinate as soon as turned under and crimson clover is an annual. These legumes, as a rule, are ready to turn around the middle of April. Results of the winter legume test were given in table 12 in this bulletin.

Among the summer legumes are soybeans, velvet beans, peas and lespedeza. Lespedeza reseeds while the others must be planted every year. These legumes fit into rotations nicely and are recognized as excellent soil builders.

Pastures—Excellent pastures are easily obtained in this section by getting a start of Bermuda, carpet grass, lespedeza and white clover. Paspalum or Dallas grass will grow well in the lower wet places. Early spring clovers, such as hop clover, also help out on early spring grazing. Meadow fescue and rye grass also do well on the better classes of land. Any part of this section is well adapted to dairying provided there is a good milk market accessible. Many of our pastures carry cattle easily eight months in the year and winter legumes could carry them the other four months if necessary. Many cattle are never housed during the winter and when they are housed, it is for a very short period during cold rainy spells. Carpet grass, lespedeza and Bermuda are native to this section. Our pasture work on this station is getting off to a poor start, but the plats are now becoming established and have reseeded for the next year.

Orchards—In addition to the old variety orchard which produced excellent peaches, apples, and grapes each year, about an acre of young Elberta peach trees has been planted for fertilizer test work and has been conducted for two years. Our fruit trees are fertilized each year with one pound of 4-8-4 fertilizer for each year of age of the tree. Results show that the orchard fruits may be produced by proper attention being given to fertilizing, pruning, spraying and cultivation.

Boll Weevil Work—Hibernation and boll weevil emergence work has been conducted in co-operation with Mr. O. M. Chance, Jackson, Mississippi, of the State Plant Board. At present, there are two cages in the woods and two cages in the open fields that contain five hundred weevils each. In the spring daily records are kept to determine the daily emergence. Those that do not emerge will be listed as not surviving the winter. Only two weevils out of two thousand emerged at this station during 1930. Ten per cent emerged in 1929. In addition to this, the station is conducting poison work with cotton. It pays to poison judiciously.

Improvements—Very little has been done in the line of improvements this past year as all of our meager appropriation was consumed in carrying out actual experimental work. Minor repair work to the buildings and some new drainage projects are now under way. A new tenant house is badly needed.

Bulletin No. 288 December, 1930

Cotton Variety Summary

1926—1930

By
J. F. O'KELLY AND W. W. HULL

MISSISSIPPI AGRICULTURAL EXPERIMENT STATIONS
A. & M. COLLEGE, MISSISSIPPI
W. R. PERKINS, Director

COTTON VARIETY SUMMARY

1926-1930

By J. F. O'KELLY AND W. W. HULL

This publication contains reports of five year results with cotton varieties at A. & M. College, Holly Springs, Raymond, and Poplarville, and certain current results of interest at A. & M. College. It is intended to be a summary of the work at the hill branch stations of Mississippi for the last five years.

Table 1.—Cotton Varieties—A. & M. College—1926-1930.

	Per Acre Lbs. Lint	Total Value	Rank in Value	Percentage	Length	Bolls Per lb.
Cleveland 54	459.6	91.09	4	34.0	31/32	70
D. & P. L. 6	459.1	102.17	1	33.7	1 1/8	81
D. & P. L. 4-8	447.8	91.46	3	36.6	1	72
Piedmont Cleveland	444.2	85.98	7	33.1	29/32	69
Delfos (1)	423.7	95.33	2	31.2	1 1/8	78
Half and Half	410.5	73.80	13	40.3	13/16	69
Wilson Type	403.6	78.26	11	32.8	29/32	73
Coker Cleveland	396.6	84.41	8	33.5	1 1/32	68
Lone Star	394.2	84.00	9	33.5	1 1/16	64
Express	393.2	89.85	5	31.4	1 5/32	77
Acala	388.6	81.17	10	33.4	1 1/32	68
Miller	354.7	75.02	12	32.8	1 1/32	59
Webber	331.6	87.41	6	28.7	1 7/32	69

(1) Delfos 911 three years; Missdel 2 two years.

Table 2.—Cotton Varieties—Holly Springs—Valley Test—1926-30.

	Per Acre Lint	Value	Rank in Value	Percentage	Length	Bolls (1) Per lb.
D. & P. L. 4-8	686.5	129.03	1	37.3	1	84
Half and Half	683.1	112.60	10	39.5	27/32	74
Cleveland 54	664.6	123.79	4	33.6	31/32	78
Lone Star	644.0	126.35	2	33.3	1 1/16	67
Miller	615.7	120.22	7	32.9	1 1/32	60
Wilson Type	610.3	108.53	11	32.1	29/32	78
Piedmont Cleveland	607.6	107.02	12	32.3	29/32	73
Acala	607.3	115.88	9	33.7	1 1/32	74
Delfos	598.7	126.02	3	31.6	1 1/8	88
D. & P. L. 6	584.9	121.82	5	34.2	1 1/8	89
Lightning Express	547.6	118.79	8	31.5	1 5/32	90
Deltatype Webber	508.5	120.86	6	30.4	1 7/32	70

(1) Sizes for 1930 only.

In the tabulations, the varieties are arranged in order of pounds of lint produced to the acre. The total value is the sum of the values of seed and lint. Seed were valued at approximate oil mill prices, which was $22.00 a ton in 1930. The values for lint were based on middling cotton of different staple lengths and, in most years, were season averages. For example, in 1930, weekly reports for different lengths of middling cotton for ten weeks of the harvesting season, beginning with the last week in August, were averaged, and the average prices so obtained were used in the 1930 computations.

The tables of averages do not contain more varieties because varieties are being changed constantly, and only a few were in the tests for five years, although each year twenty to twenty-five varieties were included. In fact a few combinations were made. In a few cases, the average for D. & P. L. 4-8 includes two years of D. & P. L. 4, which is very similar in some respects. The Delfos average in some cases includes Delfos 911 and Missdel 2. In some cases, the Express average includes one year of Express 121, the data for the other years being for Lightning Express.

Since there are only a few varieties in these averages, the importance of rank is lessened. A variety which is sixth in a group of ten might be sixteenth in a group of twenty-five. Differences in pounds or dollars should receive more emphasis than relative rank.

Table 3.—Cotton Varieties—Holly Springs—Hill Test—1926-30.

	Per Acre		Rank in			Bolls (1)
	Lint	Value	Value	Percentage	Length	Per lb.
Half and Half	507.3	83.01	4	43.8	25/32	84
D. & P. L. 4-8	438.3	80.62	6	39.7	31/32	96
Lone Star	433.4	84.23	2	36.0	1 1/32	79
D. & P. L. 6	425.2	86.32	1	37.4	1 3/32	117
Cleveland 54	424.6	76.70	10	36.9	15/16	92
Acala	415.4	78.75	8	36.4	1	95
Wilson Type	413.2	73.72	11	35.3	7/8	96
Delfos	405.8	83.30	3	34.4	1 3/32	108
Miller	405.8	78.52	9	35.9	1	71
Piedmont Cleveland	404.3	70.47	12	35.5	27/32	86
Lightning Express	396.4	82.95	5	34.4	1 3/32	104
Deltatype	345.7	79.36	7	33.2	1 5/32	88

(1) Sizes for 1930 only.

Table 4.—Cotton Varieties—Raymond—1926-30.

	Per Acre				
	Lbs. Lint	Value	Rank in Value	Percentage	Inches
Cleveland 54	607.9	110.95	3	36.0	31/32
D. & P. L. 4-8	587.9	107.32	5	38.4	1
Delfos 911	571.5	120.59	1	33.3	1 1/8
Half and Half	560.9	91.63	11	41.6	13/16
D. & P. L. 6	552.7	113.91	2	35.7	1 1/8
Wilson Type	551.1	98.56	10	34.4	29/32
Lone Star 65	536.9	105.11	6	34.7	1 1/16
Acala	532.0	100.52	9	35.3	1
Miller	519.2	100.71	7	34.7	1 1/32
Lightning Express	512.0	108.12	4	32.9	1 1/8
Cleveland, Piedmont	503.9	90.95	12	34.4	7/8
Cleveland, Coker	478.1	89.16	13	35.7	1
Deltatype Webber	419.8	100.58	8	31.7	1 7/32

The weight one should attach to the per acre values will vary with the system of marketing, with soil type, and with labor used in production and harvesting. These values will mean much to one who is prepared to receive through marketing association or other agency the full value of the staple, whatever its length. On thin to comparatively thin soils, dwarf and extremely long varieties will seldom be satifactory. Vigorous growing medium to short types are best on such soils. Labor is becoming more particular about easy picking varieties and such varieties must sometimes be chosen with some sacrifice in production and value.

By studying the results reported in this bulletin with his particular needs in mind, the grower can eliminate from consideration certain varieties at once. It may happen that he is unable to make a choice between several varieties, any one of which would be satisfactory for his conditions. Under such cir-

cumstances, he should be influenced by the purity and productivity of the seed offered for sale.

Those men who have had charge of the hill branch stations for the last five years are due full credit for the data presented from those stations and their excellent cooperation is hereby acknowledged.

Table 1 is a five-year summary of the main variety test at the Central Station. This test was conducted on soil of moderate fertility and was usually fertilized with 500 to 600 pounds of 6-8-4 fertilizer to the acre. The low yields are due more to cotton flea hopper and weather damage than to boll weevil injury.

Table 5.—Cotton Varieties—Poplarville—1926-30.

	Per Acre				
	Lbs. Lint	Total Value	Rank in Value	Percentage	Length
Cleveland 54	336.4	62.61	4	35.5	15/16
D. & P. L. 6	333.7	69.72	1	35.8	1 3/32
Half and Half	330.3	54.02	11	41.5	13/16
Wilson Type	324.3	59.65	5	33.4	7/8
Delfos	315.7	64.87	2	33.6	1 3/32
D. & P. L. 4-8	314.4	58.34	6	37.6	31/32
Piedmont Cleveland	310.6	55.79	7	34.2	7/8
Acala	291.9	55.76	8	34.5	1
Express	291.6	63.20	3	33.1	1 3/32
Miller	286.2	55.61	9	34.4	1
Lone Star	280.3	54.76	10	35.1	1 1/32
Deltatype Webber	208.1	49.49	12	31.6	1 3/16

Table 6.—Standard Varieties—1930.

	Lbs. lint per acre	Total value	Rank in value	Lint data Percentage	Length	Cents per lb.	Bolls per lb.
D. & P. L. 10	417.5	53.64	1	35.5	1 1/32	10.85	79
Cleveland 54	383.1	45.81	3	34.3	15/16	9.85	78
D. & P. L. 6	346.4	46.41	2	34.4	1 3/32	11.30	87
Piedmont Cleveland	338.1	36.26	12	32.6	27/32	8.45	78
Stoneville 3	317.4	40.54	8	36.4	1 1/32	10.85	87
Acala 37	313.9	41.43	7	31.9	1 1/32	10.85	78
Roldo Rowden 40	310.1	38.37	10	33.6	31/32	10.20	68
Missdel 2	309.4	42.00	5	32.6	1 3/32	11.30	88
Express, Light	307.8	43.19	4	31.6	1 1/8	11.65	90
Wilson Type	307.5	33.07	17	32.3	27/32	8.45	82
Express 17	305.4	41.92	6	31.2	1 3/32	11.30	80
Stoneville 1	294.6	38.96	9	34.1	1 1/16	11.10	70
D. & P. L. 4-8	284.9	34.58	15	36.2	31/32	10.20	82
Cleveland 884	284.7	35.37	14	33.1	31/32	10.20	82
Stoneville 2	283.4	36.99	11	33.3	1 1/32	10.85	80
Miller 3286	266.1	33.06	18	33.1	31/32	10.20	67
Express 41077	260.3	35.52	13	31.9	1 3/32	11.30	77
Miller 5111	255.4	30.42	20	34.8	15/16	9.85	69
Half and Half	245.4	23.57	22	43.9	3/4	8.20	77
Lone Star 566	239.4	31.64	19	34.2	1 1/16	11.10	74
Missdel 1	234.1	33.98	16	32.2	1 5/32	12.20	75
Deltatype Webber	182.6	29.08	21	28.0	1 3/16	13.10	78

The results reported in Tables 2, 3, 4, and 5 were obtained with seed from the same sources as in the Central Station results. Before time for planting, seed of all varieties were assembled at A. & M. College. Whenever possible, seed of each variety was obtained from the originator of the variety. The shipments were divided and the proper amount of each variety was sent to each branch station.

The Holly springs results are given in Tables 2 and 3, the first being conducted on valley land of that section and the other on higher hill or table

land. These soils had been improved with legumes and, as a rule, the cotton crops were well fertilized with approximately a 4-8-4 mixture.

At Raymond, valley and hill tests have been run for only four years. These tests were averaged for each year and this average used as the yield for that particular year. The results reported in Table 4 are, therefore, an average of averages obtained from both the valley and hill tests. The Raymond results were obtained on soil of medium fertility and which was well fertilized. The moisture supply was more nearly adequate at Raymond in 1930 than at many other stations in the state.

The Poplarville results are given in Table 5. They were obtained on typical coastal plains soil and the tests were well fertilized for such soils.

Current Results

Tables 6, 7, 8, and 9 report certain results for 1930. Except where otherwise indicated, the data were obtained at A. & M. College.

Conditions during 1930 were very abnormal. After the very excessive rains during the first half of May, only two light showers were received until the middle of August. On many of the tests, the cotton flea hopper delayed rapid fruiting until late in the summer. For this reason, a high proportion of the crop was set late and was matured in September and early October. After the rains came, the leaf worm appeared in large numbers. Its first attacks were controlled by calcium arsenate. In October, it was allowed to remove all leaves. The boll weevil was not a factor at any time on the college farm during the year.

The main variety test reported in Table 6 contained twenty-two varieties and strains, practically all of which are availible in commercial quantity.

Table 7.—Standard and New Varieties—1930

	Per acre						
	Lbs. lint	Total value	Rank in value	Percentage	Length	Cents per lb.	Bolls per lb.
Cleveland 54	357.6	41.93	7	35.2	29/32	9.70	82
Stoneville 4	355.8	43.50	5	35.2	31/32	10.20	69
Foster 6	347.0	47.55	1	34.9	1 1/8	11.65	91
Super Seven	346.2	45.89	3	33.8	1 1/16	11.10	80
Miller 3286	339.3	40.44	9	34.7	15/16	9.85	65
Delfos 719	328.5	42.23	6	35.4	1 1/32	10.85	76
Acala, A. & M.	321.2	41.54	8	37.5	1 1/16	11.10	71
Delfos 6112	317.9	44.65	4	31.5	1 1/8	11.65	85
Stoneville 3	315.8	39.16	10	37.3	1	10.55	93
Wilds	304.0	46.70	2	32.7	1 3/16	13.10	77
D. & P. L. 5242	294.2	34.57	12	41.5	31/32	10.20	82
Cleveland 5	289.8	33.85	15	35.7	29/32	9.70	89
Wilson Type	287.3	30.04	19	33.8	13/16	8.30	81
Lone Star P-4-1	284.5	33.24	16	37.5	15/16	9.85	63
Cleveland 884	275.7	33.85	14	34.6	31/32	10.20	89
Coker's 234	274.8	35.80	11	36.3	1 1/16	11.10	80
Lone Star D-2-1	262.1	31.53	17	37.5	31/32	10.20	76
Wilson 26 WC-5-M	255.2	31.19	18	31.7	15/16	9.85	105
Missdel 2	251.9	33.96	13	33.5	1 3/32	11.30	94
Lone Star 566	232.9	28.37	21	35.7	31/32	10.20	80
Deltatype Webber	202.7	29.93	20	30.0	1 5/32	12.20	83

The test of new and standard varieties, Table 7, and miscellaneous test, Table 8, contain much comparatively new material. These two tests were planned to study the merits of new strains about to be offered to cotton growers.

For several years, Red Leaf cotton has been increasing in popularity in certain sections of the state. Various and conflicting reports of its merits

have been circulated. This cotton was tried in 1930 with the results reported in Table 9.

The test at the Central Station had ten replications and, shortly before the plants began to set squares, plant counts were made and all rows of each replication were thinned to the same number of plants to the row. Since this test contained only four varieties with ten replications on soil of reasonable uniformity and since each variety was represented by the same number of plants, it is believed this test is as accurate as any one test can be made.

Table 8.—Miscellaneous Varieties—1930.

	Per acre Lbs. lint	Total value	Rank in value	Percentage	Length	Cents per lb.	Bolls per lb.
Cleveland 54	612.3	75.29	1	34.4	31/32	10.20	64
Stoneville 3	586.8	75.14	2	36.0	1 1/32	10.85	74
Half and Half, M	558.7	55.82	12	39.4	13/16	8.30	63
Addison's Pro.	526.1	60.51	7	37.9	29/32	9.70	65
Lone Star 561	525.6	68.06	3	34.4	1 1/32	10.85	61
Stoneville 2	479.9	64.18	4	32.6	1 1/16	11.10	66
Miller 3286	469.2	61.43	5	32.9	1 1/32	10.85	53
Acala 37	462.6	61.21	6	31.6	1 1/32	10.85	63
Lone Star 562	452.0	59.12	8	35.7	1 1/16	11.10	57
Gosa	450.9	55.84	11	33.5	31/32	10.20	60
Lone Star 566	438.7	58.15	10	33.8	1 1/16	11.10	58
Acala, A. & M.	431.5	58.75	9	35.9	1 1/8	11.65	55
Miller 589	422.4	54.38	13	35.2	1 1/32	10.85	51
Miller 5111	399.5	50.60	14	34.2	1	10.55	52
Half and Half, S	364.6	35.37	18	42.3	25/32	8.20	58
Miller 5115	361.4	44.61	15	33.9	31/32	10.20	52
Miller, Barrett	312.6	40.06	16	32.7	1	10.55	53
Miller, Smith	304.9	40.04	17	32.5	1 1/32	10.85	51

The test in Neshoba County was supervised closely enough by a member of the department that it is known to be dependable.

The Poplarville results were obtained in the usual way by those in charge of the Poplarville Branch Station.

As a rule, the Red Leaf cotton, when pure, is medium early to late; has long internodes; has big bolls which pick easily; has a medium to short staple and a fairly high lint percentage; and its vigor gives it some degree of wilt resistance.

Table 9.—Red Leaf Tests—1930.

	Per Acre Lbs. Lint	Value	Rank in Value	Lint data Percentage	Inches	Bolls Per lb.
A. & M. College						
Cleveland 54	333.5	39.85	1	34.4	15/16	73
Red Leaf 1	231.2	26.97	3	37.7	15/16	63
Miller 589	309.3	38.76	2	35.7	1	61
Red Leaf 2	209.9	24.89	4	35.4	15/16	65
Neshoba County						
Cleveland 54	453.2	46.90	1	36.7	27/32	85
Red Leaf	431.2	43.47	2	40.3	27/32	70
Poplarville, Miscellaneous Test						
Cleveland 54	253.7	29.98	1	34.2	29/32	
Red Leaf	188.1	18.93	2	38.4	13/16	
Poplarville, Wilt Test						
Cleveland 54	198.8	20.97	1	34.4	27/32	
Red Leaf	66.0	6.75	2	38.4	27/32	

Red Leaf cotton has existed for more than one hundred years and, although it has several desirable characteristics, it does not have qualities which cannot be had in other varieties, and it is impossible to produce pure seed in a

community where it and green leaf types are being grown. A few plants of either color in the other will make no material difference as far as production is concerned, but it is impossible to sell either as pure seed. Any community producing pure seed for sale as such should outlaw Red Leaf cotton.

Keep Seed Pure and Productive

Since the average farmer has little or no time for doing cotton breeding work, even if he were inclined that way, it is necessary that he adopt some method whereby he may keep his cotton variety pure and productive. The simplest way is for him to purchase, occasionally, several bushels seed of a good variety from a reputable breeder. This should be planted a few hundred yards from other cotton to avoid mixing. It should be picked separately and ginned when time will permit cleaning the gins thoroughly. The seed so obtained will be excellent for planting the general crop the following year. By repeating this procedure each year or two, the main crop can always be planted with pure productive seed at a nominal cost.

If a grower's acreage is sufficiently great and he has the inclination and training, he may find it profitable to improve his variety by mass selection. In mass or field selection, the field should be gone over after many of the bolls have opened. The plants should be studied for production, disease resistance, boll size, lint percentage, uniformity of staple and any other characters which may be a part of the idea in mind. The time required for this work can be decreased and its efficiency increased if the plants where the work is being done are spaced one to a hill and well fertilized. The selected plants should be tagged or otherwise marked and picked as soon as nearly all the bolls are open.

The cotton obtained as indicated can be ginned in one lot on a gin varying in size from ten saws to a standard gin. The size of the gin should be governed in part by what is available and in part by the quantity of cotton to be ginned. The seed obtained in this way can be planted in an increase field and the process of selection can be repeated the following fall. The seed left after the selected plants have been removed will be good for general crop planting.

More intensive cotton breeding should be undertaken only by those having the proper training and material equipment.

Mass selection has just been stressed because only in this way or by more intensive breeding methods can the productivity of a variety be maintained. Seed can be kept pure if properly isolated in the field and ginned on scrupulously cleaned gins. But maintaining productivity is another problem, since any variety will begin to deteriorate after a few years unless subjected to some system of improvement. Where whole communities are organized to grow only one variety, arrangements should be made for a regular supply of improved seed. The advantages of such one-variety communities will be lessened if unimproved seed be used.

The cleaning of gins requires more care than is realized by most growers and ginners. The seed roll should be dumped and all seed removed from the roll box. Doffing rolls, cleaning feeders, belt distributors, and pneumatic distributors will all have more or less seed cotton which should be removed. It is very difficult to clean seed conveyors and, ordinarily, the seed should be caught in tin boxes in front of the gin and sacked from these boxes. Seed should not be sold as pure unless the cleaning is thorough.

SEED SOURCES

Acala 37.—Cotton Branch Station, Marianna, Arkansas.
Acala, A. & M.—Mississippi Experiment Station, A. & M. College, Miss.
Addison's Pro.—W. P. Addison, Blackwells, Georgia.
Cleveland, Pied.—J. O. M. Smith, Commerce, Georgia.
Cleveland 884.—Coker Ped. Seed Co., Hartsville, South Carolina.
Cleveland 5.—Coker Ped. Seed Co., Hartsville, South Carolina.
Cleveland 54.—Mississippi Experiment Station, A. & M. College, Miss.
Coker 234.—Coker Ped. Seed Co., Hartsville, South Carolina.
Delfos 6112.—Stoneville Ped. Seed Co., Stoneville, Mississippi.
Delfos 719.—Stoneville Ped. Seed Co., Stoneville, Mississippi.
D. & P. 4-8.—Delta and Pine Land Co., Scott, Mississippi.
D. & P. L. 6.—Delta and Pine Land Co., Scott, Mississippi.
D. & P. L. 10.—Delta and Pine Land Co., Scott, Mississippi.
D. & P. L. 5242.—Delta and Pine Land Co., Scott, Mississippi.
Deltatype Webber.—Coker Ped. Seed Co , Hartsville, South Carolina.
Express, Light.—Coker Ped. Seed Co., Hartsville, South Carolina.
Express 17.—Cotton Branch Station, Marianna, Arkansas.
Express 41077.—Delta Pure Seed Association, Clarksdale, Mississippi.
Foster 6. Coker Ped. Seed Co., Hartsville, South Carolina.
Gosa.—M. A. Gosa, Pheba, Mississippi.
Half and Half, M.—H. K. Mahon, Holly Springs, Mississippi.
Half and Half, S.—B. F. Summerour, Norcross, Georgia.
Lone Star D-2-1.—U. S. Cotton Breeding Field Station, Greenville, Texas.
Lone Star P-4-1.—U. S. Cotton Breeding Field Station, Greenville, Texas.
Lone Star 561.—Mississippi Experiment Station, A. & M. College, Miss.
Lone Star 562.—Mississippi Experiment Station, A. & M. College, Miss.
Lone Star 566.—Mississippi Experiment Station, A. & M. College, Miss.
Miller, Barrett.—J. C. Barrett, Saltillo, Mississippi.
Miller, Smith.—Joe Smith, Guntown, Mississippi.
Miller 3286.—Mississippi Experiment Station, A. & M. College, Miss.
Miller 589.—Mississippi Experiment Station, A. & M. College, Miss.
Miller 5111.—Mississippi Experiment Station, A. & M. College, Miss.
Miller 5115.—Mississippi Experiment Station, A. & M. College, Miss.
Missdel 1.—Delta Pure Seed Association, Clarksdale, Mississippi.
Missdel 2.—Delta Pure Seed Association, Clarksdale, Mississippi.
Red Leaf No. 1.—A. H. Alford, Lake, Mississippi.
Red Leaf No. 2.—Scott County High School, Harperville, Mississippi.
Roldo Rowden 40.—R. L. Dortch, Scott, Arkansas.
Stoneville 1.—Stoneville Ped. Seed Co., Stoneville, Mississippi.
Stoneville 2.—Stoneville Ped. Seed Co., Stoneville, Mississippi.
Stoneville 3.—Stoneville Ped. Seed Co., Stoneville, Mississippi.
Stoneville 4. Stoneville Ped. Seed Co., Stoneville, Mississippi.
Super Seven.—Coker Pedigreed Seed Co., Hartsville, South Carolina.
Wilds.—Coker Ped. Seed Co., Hartsville, South Carolina.
Wilson Type.—Lee Wilson Co., Wilson Arkansas.
Wilson 26-WC-5-M.—Lee Wilson Co., Wilson, Arkansas.

Bulletin No. 289 January, 1931

COMMERCIAL FERTILIZERS FOR COTTON

1925-1930

BY

AGRONOMY DEPARTMENT

MISSISSIPPI AGRICULTURAL EXPERIMENT STATIONS

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION

A. & M. COLLEGE, MISSISSIPPI

W. R. PERKINS, Director

SUMMARY

The data reported in this bulletin indicate that the fertilizers listed below will probably be the most profitable for the respective soil areas:

Northeast Prairie

Black Prairie	8-4-0
Red Prairie	8-8-4
Sandy bottom soils	4-8-8
Shortleaf Pine, Northeast Highland, Flatwoods, and Longleaf Pine	8-8-4

Brown Loam

Hill land	8-8-8
Bottom land	4-8-8

Suitable analyses have given large profits per dollar invested on all soil areas, even with low price cotton, as seen in Table B of the Appendix.

COMMERCIAL FERTILIZERS FOR COTTON, 1925-1930

By AGRONOMY DEPARTMENT

MISSISSIPPI AGRICULTURAL EXPERIMENT STATIONS

The purpose of this bulletin is to present the data on the use of commercial fertilizers which have been collected by the Agronomy Department of the Mississippi Experiment Stations since 1925. Tests were started in that year to get information concerning analyses and rates of mixed fertilizers, and sources of nitrogen, phosphorus, and potassium. Some of the tests have been continued to the present time, others have been discontinued, while new tests have been started from time to time which would add to the information being found in the older tests and cover more soil types. The principal soil areas of the state have been studied, but only those outside the Delta are reported here.

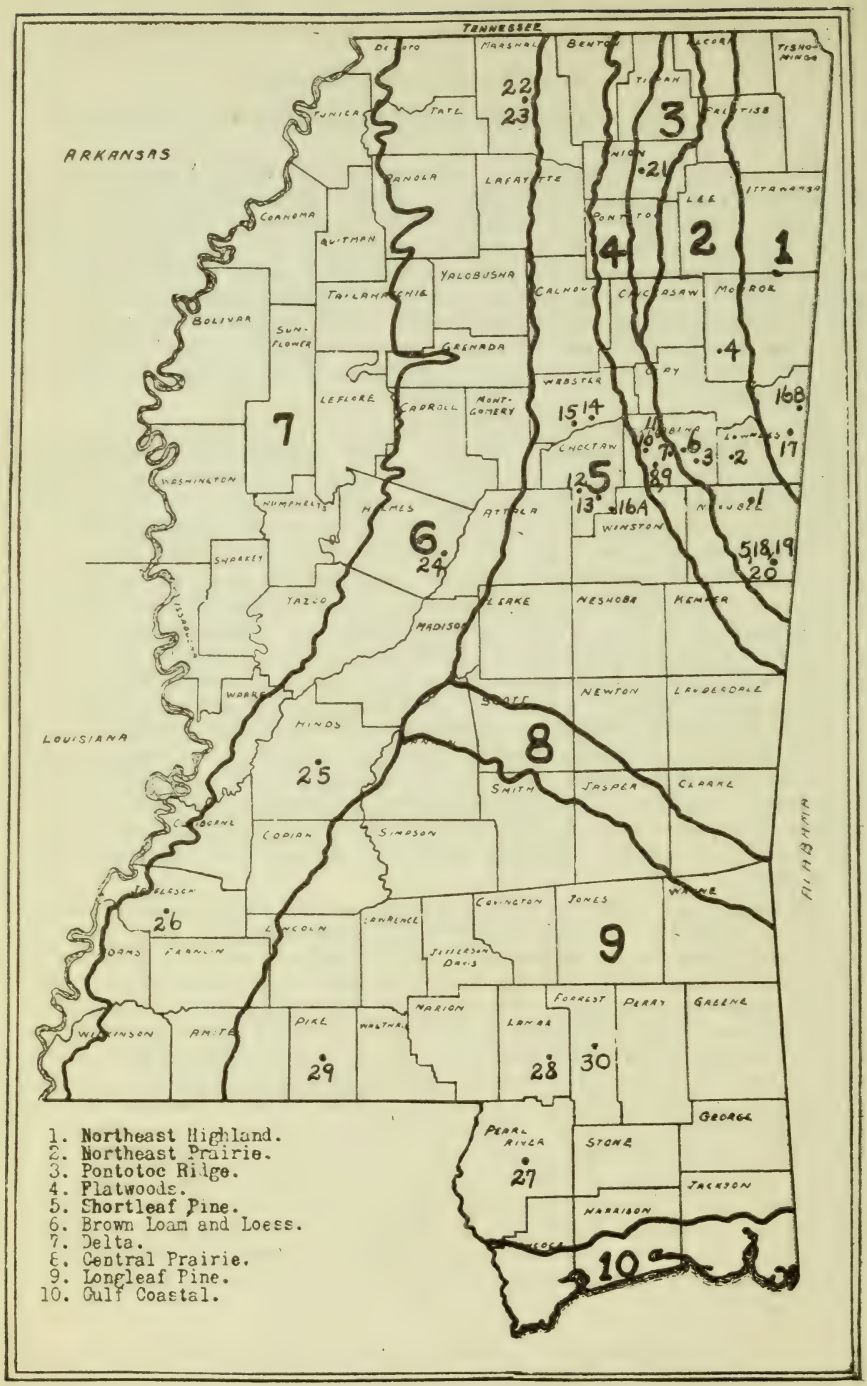
Some tests have been on the Experiment Station farms, but many have been conducted on the farms of farmers where suitable soil and cooperation existed. In either case, the application of the fertilizers and the harvesting of the crop were supervised by a representative of one of the Experiment Stations. Such things as the choice of planting seed, preparation of the seed bed, cultivation, etc., were left entirely with the cooperating farmer.

The results of the analyses and rates tests are presented in tables giving the increases in pounds of seed cotton over no fertilizer, and the net profit on investment in fertilizer. The profit depends upon the amount of the increase, the selling price of cotton, and the cost of the fertilizer. The profits reported in this bulletin were based on costs of fertilizer and prices of cotton prevailing at the time the tests were run.* It is readily seen that these profits would be changed if different costs and prices were used. These can be obtained from market quotations for any year. If one is inclined to speculate on what the costs and prices will be in the future, he can easily apply his speculations to the increases reported here and arrive at an arbitrary profit. However, the increases to be expected from the use of various analyses and rates of fertilizer are not arbitrary and can be determined only from experimental data.

Interpretations of the data and conclusions are presented for each test and for each general soil area. There are several viewpoints from which the data might be analyzed. On reaching the conclusions presented here, the behavior of each analysis in the test was considered in relation to every other analysis to which it could be compared. In attempting to determine which analysis yielded the greatest profit per dollar invested, increases and profits were considered in relation to the cost of fertilizer. As a result of this viewpoint, it sometimes happened that the data indicated an analysis to be most profitable which was not in the test; or one which, if in the test did not show the greatest profit per acre. Where such analyses have been selected as likely to be most profitable, there are evidences of one kind or another in the data which lead one to believe that they would be most profitable with a given investment. The most profitable rate of application can be determined by a simple inspection of the tables. The most economical rate of application depends upon many factors, such as limited finance, etc., which affect the individual, and no attempt has been made to analyze the data from this viewpoint.

*The prices of cotton and fertilizer used in this bulletin may be found in the appendix.

Note—The compilations and discussions were prepared for this publication by W. W. Hull and W. B. Andrews. C. B. Anders, R. Cowart J. F. O'Kelly, W. W. Hull, W. B. Andrews, and those in charge of the work at the branch stations have at various times been instrumental in planning the tests, applying the materials, and collecting data.



A SOIL MAP OF MISSISSIPPI

The map on opposite page shows the location of the soil areas in Mississippi. The small figures on the map designate the approximate location of the tests reported in the tables of the same numbers.

Northeast Prairie*

The Northeast Prairie is a narrow belt of land which extends from the Tennessee line at Alcorn County to the Alabama line at Noxubee County. It is bordered by the Northeast Highland on the East and by the Flatwoods and the Pontotoc Ridge on the West. The Northeast Prairie is ten to twelve miles wide near its northern end and about twenty to twenty-four miles wide near its southern end. The soils of this area are usually of a clayey or silty nature. While the greater part of it is commonly called Black Prairie, small areas of Red Prairie, or Post Oak, exist also. Soil classes other than these two are small in extent in this soil area.

The Red Prairie, or Post Oak, soils respond to nitrogen, phosphorus, and potash in about the same manner as do the sand and clay soils of the Shortleaf Pine soil area. Three tests on Black Prairie soils reported in this bulletin were on soil which had a pH value of about 8. This indicates that they have a high amount of lime.

TABLE 1—BLACK PRAIRIE. NOXUBEE. BROOKSVILLE. DALE BELL—1926-27-28

N-P-K	INCREASE '26	'27	'28	Average	PROFIT '26	'27	'28	Average
			Varying Analysis (600 Pounds Per Acre)					
4-8-8	367	318	246	310	8.56	12.90	6.23	9.23
4-8-6	342	304	204	283	7.94	12.53	4.26	8.24
4-8-4	338	319	207	288	8.45	14.21	4.94	9.20
4-8-2	428	331	248	336	13.60	15.61	7.97	12.39
4-8-0	377	358	245	327	11.71	18.14	8.26	12.70
8-8-4	544	559	539	544	14.31	26.32	20.20	20.28
6-8-4	466	440	463	456	12.61	20.36	18.24	17.07
4-6-4	478	347	367	397	16.09	16.71	15.13	15.98
4-4-4	487	371	368	409	17.22	18.97	15.75	17.31
			Varying Rate (Analysis 4-8-4)					
1200 lbs.	609	539	416	521	13.51	21.45	10.06	15.01
1800 lbs.	713	587	529	610	10.24	16.69	9.85	12.09
2400 lbs.	782	713	721	739	5.22	17.39	13.41	12.01
	Yield without Fertilizer							
	871	949	536	785				

The test reported in Table 1 was conducted on black Post Oak soil near Brooksville on the farm of Dale Bell. The black post oak soil is probably intermediate between the black and red soils of this area; it is probably a mixture of the two. The soil where the test was conducted is naturally fertile as indicated by the average no fertilizer yield of 785 pounds of seed cotton per acre.

Nitrogen increased the yield and profit considerably when it was increased from 4 to 6 per cent and from 6 to 8 per cent.

Four per cent phosphoric acid was the lowest rate of that element used, since the test did not include a plot with nitrogen and potash without phosphorus. These data indicate that the phosphoric acid content of the fertilizer for this soil should not be greater than the nitrogen content. However, they do not indicate it should be as large, and reference is made to tests reported in Tables 3 and 4 to determine the correct ratio of phosphoric acid to nitrogen.

Potash usually did not increase the yield.

These data indicate that high amounts of nitrogen are profitable, that potash does not pay, and that the status of phosphorus is questionable. The

*Descriptions of all the soil areas reported in this bulletin were taken from the "Soils of Mississippi" by W. N. Logan, 1916, Miss. Agr. Exp. Sta. Tech. Bul. No. 7.

analysis may be stated 8-(?)-0, and reference should be made to tests reported in Tables 3 and 4 and the summary of the black land tests.

TABLE 2—BLACK PRAIRIE, LOWNDES, ARTESIA, BAILEY HARDY—1926-27-28

	INCREASE				PROFIT			
N-P-K	'26	'27	28	Average	'26	'27	'28	Average
			Varying Analysis (600 Pounds Per Acre)					
4-8-8	339	383	139	287	7.15	17.48	-0.20	8.14
4-8-6	315	322	157	265	6.62	13.81	1.44	7.29
4-8-4	316	345	161	274	7.32	16.01	2.18	8.50
4-8-2	332	351	174	286	8.81	17.07	3.53	9.80
4-8-0	307	345	145	266	8.24	17.21	2.32	9.26
8-8-4	614	652	297	521	17.83	32.86	6.22	18.97
6-8-4	512	548	252	437	14.90	27.85	5.59	16.11
4-6-4	346	362	123	277	9.51	17.79	0.46	9.25
4-4-4	299	331	115	248	7.83	16.15	0.54	8.17
			Varying Rate (Analysis 4-8-4)					
1200 lbs.	631	660	312	534	14.64	29.97	3.78	16.13
1800 lbs.	831	911	350	697	16.13	39.40	-1.36	18.06
2400 lbs.	920	1091	375	795	12.12	43.84	-7.36	16.20
	Yield without Fertilizer							
	360	491	218	357				

The test reported in Table 2 was conducted on black Post Oak soil near Artesia on the farm of Bailey Hardy. This soil probably exhibits the characteristics of the Red Prairie soils slightly more than does the soil which was used for the test reported in Table 1. The average yield of 357 pounds of seed cotton per acre without fertilizer indicates that this soil is not naturally fertile.

Nitrogen produced profitable increases when increased from 4 to 6 per cent and from 6 to 8 per cent.

Phosphoric acid, when increased above 4 per cent, did not materially increase the yield and profit in this test, and reference should again be made to the tests reported in Tables 3 and 4 to determine the correct ratio of phosphoric acid to nitrogen to use.

Potash did not increase the yield profitably.

These results indicate that nitrogen is profitable in rather high amounts, that the status of phosphorus is questionable, and that potash does not pay. The analysis may be written 8-(?)-0 for this soil.

The tests reported in Tables 1 and 2 were run in 1926, 27, and 28. These tests did not have a No Phosphorus plot which had applications of nitrogen and potash, and the profitableness of phosphorus as a fertilizer for cotton as concluded from these two tests was in doubt. In 1928, the tests reported in Tables 3 and 4 were started. They throw more light on the use of phosphorus.

TABLE 3—BLACK PRAIRIE, OKTIBBEHA, SESSUMS, LUTZ FRYE—1928-29-30

		INCREASE				PROFIT			
Rate	N-P-K	'28	'29	'30	Average	'28	'29	'30	Average
300 lbs.	8-0-0	190	296	81	189	7.23	13.79	-1.09	6.64
300 lbs.	8-4-0	210	347	95	217	7.85	16.13	-1.24	7.58
300 lbs.	8-8-0	138	312	43	164	3.02	13.40	-3.76	4.22
600 lbs.	8-0-0	340	390	112	281	12.09	15.38	-3.93	7.85
600 lbs.	8-4-0	385	541	103	343	13.66	23.10	-5.58	10.39
600 lbs.	8-8-0	320	530	153	334	8.64	21.12	-5.14	8.21
900 lbs.	8-0-0	499	522	224	415	17.44	19.30	-3.91	10.94
900 lbs.	8-4-0	482	601	160	414	14.76	22.03	-8.16	9.54
900 lbs.	8-8-0	466	498	149	371	12.13	13.89	-10.53	5.16
		Yield without Fertilizer							
		616	455	409	493				

The test reported in Table 3 was conducted on black silt loam bottom land near Sessums on the farm of Lutz Frye . The natural fertility of this soil is not high as indicated by the yield of 493 pounds of seed cotton per acre without fertilizer.

Eight per cent nitrogen was highly profitable in the 300 pound, 600 pound and 900 pound rates of application.

Four per cent phosphoric acid increased the yields profitably in the 300 pound and 600 pound rates, but not in the 900 pound application. Eight per cent phosphoric acid was not profitable in any rate.

The results indicate that nitrogen may be used profitably up to 72 pounds per acre and that more than 4 per cent phosphoric acid is not profitable when the nitrogen is 8 per cent. Probably an 8-4-0 is the most profitable analysis for this soil.

TABLE 4—BLACK PRAIRIE, MONROE, PRAIRIE—C. S. STEELY—1928-29-30

		INCREASE				PROFIT			
Rate	N-P-K	'28	'29	'30	Average	'28	'29	'30	Average
600 lbs.	8-0-4	62	112	61	78	-5.66	-2.41	-6.85	-4.97
600 lbs.	8-4-4	301	700	106	369	7.58	31.49	-6.61	10.82
600 lbs.	8-8-4	331	730	111	391	8.25	32.01	-7.75	10.84
600 lbs.	8-0-0	35	-23	13	8	-6.25	-9.37	-7.38	-7.67
600 lbs.	8-4-0	379	543	32	318	13.31	23.26	-8.04	9.51
600 lbs.	8-8-0	367	649	152	389	11.46	28.25	-5.18	11.51
900 lbs.	8-0-0	12	-80	42	-9	-11.75	-16.20	-10.29	-12.75
900 lbs.	8-4-0	484	726	100	436	14.86	29.55	-10.28	11.38
900 lbs.	8-8-0	480	769	160	470	12.94	30.15	-10.14	10.98
300 lbs.	8-0-0	-52	-55	-2	-36	-7.27	-7.30	-3.97	-6.18
300 lbs.	8-4-0	123	337	60	173	2.66	15.57	-2.51	5.24
300 lbs.	8-8-0	134	357	63	185	2.76	16.09	-3.04	5.27
		Yield	without	Fertilizer					
		656	608	256	506				

The test reported in Table 4 was conducted on typical Black Prairie soil near Prairie, Mississippi, on the farm of C. S. Steely. The yield without fertilizer was 506 pounds of seed cotton per acre.

Nitrogen alone did not increase the yield. Nitrogen was very profitable when used with phosphorus. This is indicated by a comparison of the 300 pounds of 8-8-0 with the 600 pounds of 8-4-0, the latter of which produced a much larger increase. Since both applications contained the same amount of phosphorus, the greater efficiency of the 600 pounds of 8-4-0 must be attributed to the additional nitrogen. The same conclusion is reached when 600 pounds of 8-8-0 is compared with 900 pounds of 8-4-0.

Four per cent phosphoric acid was highly profitable when used with 8 per cent nitrogen. In every trial, it changed a loss on nitrogen alone to a substantial profit. Increases in phosphoric acid above 4 per cent did not materially increase the profit.

Potash when used with nitrogen in the absence of phosphorus produced an average increase of 70 pounds, but when phosphorus was used the data are inconsistent.

These data indicate that an 8-4-0 analysis is probably the most profitable for this soil.

Summary of the Black Prairie Tests

Table 1—Black post oak—Brooksville ..... 8-(?)-0
Table 2—Black post oak—Artesia ..... 8-(?)-0
Table 3—Black silt loam—Sessums ..... 8- 4 -0
Table 4—Black Prairie—Prairie ..... 8- 4 -0

As stated above, the ratio of phosphorus to nitrogen could not be determined from the data reported in Tables 1 and 2. Four per cent phosphoric acid was very profitable at Prairie and 4 per cent was fairly profitable at Sessums. Eight per cent phosphoric acid was usually not as profitable as 4 per cent at Prairie and at Sessums. Eight per cent nitrogen was profitable in all tests where phosphorus was used with it. Potash was usually not profitable. It is therefore concluded that the most profitable fertilizer for the black lands of the Northeast Prairie is probably an 8-4-0.

TABLE 5—RED PRAIRIE, NOXUBEE, MACON, CIRCLE M RANCH—1929-30

Rate	N-P-K	INCREASE '29	INCREASE '30	INCREASE Average	PROFIT '29	PROFIT '30	PROFIT Average
600 lbs.	6-0-0	59	-7	26	-2.46	-6.12	-4.29
600 lbs.	6-8-0	444	201	323	17.98	-1.50	8.24
600 lbs.	6-8-4	528	291	410	21.87	0.50	11.19
600 lbs.	6-12-4	542	316	429	21.38	0.05	10.72
300 lbs.	6-8-4	252	184	218	10.22	1.58	5.90
900 lbs.	6-8-4	701	388	544	27.35	-0.98	13.19
			Yield Without Fertilizer				
		376	310	343			

The test reported in Table 5 was conducted on the Red Prairie (post oak) soil at Circle M. Plantation near Macon. The average No Fertilizer yield of 343 pounds of seed cotton per acre indicates that this soil is naturally poor.

Nitrogen alone produced a very small average increase in yield. Six per cent nitrogen caused a loss of about $4 per acre when used alone.

When 8 per cent phosphoric acid was used with 6 per cent nitrogen, the average profit was approximately $8. Increasing the phosphoric acid from 8 to 12 per cent was not profitable.

Potash (4 per cent) when used with 6 per cent nitrogen and 8 per cent phosphoric acid increased the profit about $3 per acre.

These results indicate that nitrogen is unprofitable when used alone, that nitrogen and phosphorus, and nitrogen, phosphorus, and potash increase the yield profitably on this soil, that the phosphoric acid content of the fertilizer should not be materially greater than the nitrogen content, and that an 8-8-4 is a good fertilizer for this soil.

TABLE 6—FINE SANDY LOAM, OKTIBBEHA, A. & M. COLLGERE, STATION—1925-26-27-28-29-30

N-P-K	'25	'26	'27	'28	'29	'30	Average
	Varying Analysis (600 Pounds Per Acre)						
4-8-8 Increase	286	289	692	609	582	601	510
4-8-8 Profit	10.78	5.42	39.13	28.03	25.98	12.15	20.25
6-8-6 Increase	319	208	640	526	554	586	472
6-8-6 Profit	13.71	1.86	36.04	23.58	24.88	12.19	18.71
8-8-4 Increase	255	235	578	605	521	520	454
8-8-4 Profit	9.81	3.66	32.35	28.84	23.45	10.77	18.15
4-8-2 Increase	190	171	411	362	325	269	288
4-8-2 Profit	5.87	0.94	21.21	14.76	12.24	2.26	9.55
4-8-0 Increase	-12	13	54	73	4	92	37
4-8-0 Profit	-5.91	-6.50	-3.18	-2.03	-6.43	-8.38	-4.57
8-8-4 Increase	226	104	469	395	335	513	349
8-8-4 Profit	3.70	-7.28	20.04	12.05	8.27	6.31	7.19
6-8-4 Increase	272	168	504	512	405	469	388
6-8-4 Profit	8.98	-1.89	24.77	21.15	14.52	6.71	12.37
4-6-4 Increase	223	138	528	465	376	515	374
4-6-4 Profit	8.27	-0.52	29.40	21.00	15.39	10.95	14.08
4-4-4 Increase	165	130	511	405	295	483	332
4-4-4 Profit	4.82	-0.21	28.79	17.94	11.20	10.52	12.18
	Varying Rate (Analysis 4-8-4)						
1200 lb. Increase	633	272	841	760	472	673	608
1200 lb. Profit	28.27	-2.55	42.58	30.68	12.67	8.08	19.96
1800 lb. Increase	649	223	810	656	514	800	609
1800 lb. Profit	21.38	-13.05	32.30	16.98	7.42	4.80	11.63
2400 lb. Increase	549	228	880	614	382	899	592
2400 lb. Profit	6.34	-20.88	29.04	7.00	8.35	0.53	5.06
	Yield Without Fertilizer						
	560	371	877	602	395	590	566

The test reported in Table 6 was conducted on fine sandy loam bottom land on the college farm. This soil is in the Northeast Prairie soil area, but it does not exhibit the usual characteristics of Black Prairie soil. It is probably typical of much of the sandy loam bottom soils along the western boundary of the Northeast Prairie. The average yield without fertilizer was 566 pounds of seed cotton per acre.

The smallest rate of nitrogen application was 4 per cent. Increasing the nitrogen from 4 to 6 or 8 per cent resulted in decreased yields.

Phosphorus increased the yield of seed cotton profitably when the phosphoric acid was increased from 4 to 6 per cent and from 6 to 8 per cent.

Potash increased the yield profitably with each addition up to 8 per cent.

These data indicate that phosphoric acid and potash should be used in equal quantities and that not more than one-half as much nitrogen as of potash and phosphoric acid should be used. A 4-8-8 will furnish the above proportions of these plant foods.

The 600 pound rate made about as much profit as did the 1200 pound rate.

Flatwoods Soil Area

The Flatwoods soil area is from six to twelve miles wide, and it extends from the Tennessee line to Kemper County. It is bordered on the east by the Northeast Prairie and the Pontotoc Ridge and on the west by the Shortleaf Pine soil area. The Flatwoods soils usually vary from a heavy clay to a clay or silt loam, but there are sandy loam soils in this soil area also.

The test reported in Table 7 was conducted on Lufkin clay which is commonly called "sticky flatwoods" on the farm of Grafton Yeates near Starkville. The average yield of 346 pounds of seed cotton per acre without fertilizer indicates that this is naturally a poor soil.

TABLE 7—CLAY-OKTIBBEHA, STARKVILLE, G. YEATES—1926-27-28-29-30

N-P-K	'26	'27	'28	'29	'30	Average
Varying Analysis (600 Pounds Per Acre)						
4-8-8 Increase	385	535	118	580	279	389
4-8-8 Profit	10.24	28.12	-1.41	25.86	0.90	12.74
4-8-6 Increase	385	440	90	559	268	348
4-8-6 Profit	10.71	22.07	-2.61	25.13	1.06	11.28
4-8-4 Increase	352	473	85	526	220	331
4-8-4 Profit	9.53	24.98	-2.37	23.74	-0.02	11.17
4-8-2 Increase	288	369	30	450	146	257
4-8-2 Profit	6.81	18.26	-5.14	19.79	-2.05	7.53
4-8-0 Increase	327	410	36	468	85	265
4-8-0 Profit	9.19	21.77	-4.28	21.39	-8.60	5.90
8-8-4 Increase	548	702	148	839	205	488
8-8-4 Profit	14.90	36.36	-2.72	38.52	-4.49	16.51
6-8-4 Increase	419	614	94	741	228	419
6-8-4 Profit	10.68	32.49	-3.90	34.67	-1.70	14.15
4-6-4 Increase	337	517	81	513	214	332
4-6-4 Profit	9.42	28.58	-2.04	23.64	0.43	12.01
4-4-4 Increase	250	438	50	414	132	257
4-4-4 Profit	577	23.68	-3.33	18.35	-5.79	9.54
Varying Rate (Analysis 4-8-4)						
1200 lbs. Increase	537	866	240	975	345	593
1200 lbs. Profit	10.69	44.34	-0.50	42.85	-3.37	18.80
1800 lbs. Increase	625	1144	341	1101	434	729
1800 lbs. Profit	7.05	55.65	-1.95	42.62	-8.01	19.07
2400 lbs. Increase	791	1323	557	1257	494	884
2400 lbs. Profit	7.26	60.11	3.57	44.14	-13.64	20.29
Yield Without Fertilizer	273	568	49	482	360	346

Nitrogen increased the yield profitably when it was increased from 4 to 6 per cent and from 6 to 8 per cent.

When the nitrogen content was 4 per cent, phosphoric acid increased the yield and profit materially when increased from 4 to 6 per cent, but 8 per cent was not as profitable as 6 per cent. Considering the profit on the investment, these data indicate that the phosphoric acid content of the fertilizer for this soil should be slightly, and only slightly, higher than the nitrogen content.

Potash produced profitable increases up to 8 per cent, but the results are somewhat inconsistent.

These results indicate that the most profitable analysis for this soil is probably a 6-8-4.

The 1200 pound rate produced about 50 per cent more profit than did the 600 pound rate.

TABLE 8—SANDY CLAY LOAM—OKTIBBEHA, LONGVIEW, J. I. CUMMINS—1926-27

	INCREASE			PROFIT		
N1P-K	'26	'27	Average	'26	'27	'Average
			Varying Analysis (Rate 600 Pounds Per Acre)			
4-8-8	473	702	588	14.64	39.85	27.25
4-8-6	385	578	457	8.20	31.77	19.99
4-8-4	394	679	537	11.63	39.45	25.54
4-8-2	464	769	617	15.60	46.32	30.96
4-8-0	474	763	619	16.57	46.54	31.56
8-8-4	555	888	722	15.28	49.36	32.32
4-8-4	450	797	624	12.23	45.34	28.79
4-6-4	307	665	486	7.96	39.00	23.48
4-4-4	301	579	440	8.35	33.53	20.94
			Varying Rate (Analysis 4-8-4)			
1200 lbs.	551	895	723	11.44	46.45	28.95
1800 lbs.	685	1041	863	10.06	48.48	29.27
2400 lbs.	698	1107	903	2.64	45.00	23.82
			Yield Without Fertilizer			
	375	338	357			

The results of a test conducted on fine sandy loam on J. I. Cummins' farm near Longview are reported in Table 8. The yield of 357 pounds of seed cotton per acre without fertilizer indicates that the soil is naturally poor.

Nitrogen was profitable when increased from 4 to 6 per cent and from 6 to 8 per cent.

Phosphoric acid was profitable when increased from 4 to 6 per cent and from 6 to 8 per cent. However, 1200 pounds of 4-8-4 produced the same yield as 600 pounds of 8-8-4, which seems to indicate equal parts of nitrogen and phosphoric acid to be the most efficient ratio between these elements.

Potash did not increase the yield.

These results indicate that phosphoric acid and nitrogen are profitable on this soil, but they do not indicate definitely the best analysis to use.

These results indicated that another test would have to be installed if a desirable ratio of nitrogen and phosphoric acid was to be determined ,and the test reported in Table 9 was started in the same field, but on different land. Both tests should be considered before conclusions are drawn as to which is the most profitable fertilizer analysis to use on this soil.

TABLE 9—SANDY CLAY LOAM—OKTIBBEHA, LONGVIEW, J. I. CUMMINS—1928-29-30

		INCREASE				PROFIT			
Rate	N-P-K	'28	'29	'30	Average	'28	'29	'30	Average
300 lbs.	6-4-4	342	467	150	320	16.34	23.77	1.08	13.73
300 lbs.	6-6-4	348	544	139	344	16.37	28.07	0.35	14.93
300 lbs.	6-8-4	347	520	209	359	16.05	26.32	2.45	14.94
600 lbs.	6-4-4	572	776	250	533	25.91	38.08	0.37	21.45
600 lbs.	6-6-4	714	845	278	612	33.86	41.52	0.70	25.36
600 lbs.	6-8-4	619	906	312	612	27.60	44.52	1.28	24.45
900 lbs.	6-4-4	673	984	265	640	27.73	46.29	-3.27	23.58
900 lbs.	6-6-4	748	1066	308	707	31.42	50.24	-3.27	26.13
900 lbs.	6-8-4	794	1113	321	743	33.33	52.06	-8.29	27.37
					Yield Without Fertilizer				
		150	260	192	201				

The test reported in Table 9 was conducted in the same field as the test reported in Table 8. The No Fertilizer yield in this test was considerably less than in the former test. The test reported in Table 8 indicated that nitrogen was profitable on this soil; so it was kept at 6 per cent in all of this test.

Phosphoric acid increased the yield profitably in the 300 pound, 600 pound, and 900 pound rates when increased from 4 to 6 per cent, but when it was increased from 6 to 8 per cent the increases were not profitable.

All treated plots received 4 per cent potash. The test reported in Table 8 indicated that potash was not needed on this soil.

The results of the tests reported in Tables 8 and 9 indicate that equal parts of nitrogen and phosphoric acid are best for this soil. 8-8-0 or 6-6-0 will furnish equal parts of these two plant foods.

The 600 pound rate was nearly twice as profitable as the 300 pound rate.

TABLE 10—FINE SANDY LOAM—OKTIBBEHA, STARKVILLE, W. C. BUTLER—1926

N-P-K	Increase '26	Profit '26
Varying Analysis (Rate 600 Pounds Per Acre)		
4-8-8	485	12.73
4-8-6	449	13.90
4-8-4	395	11.66
4-8-2	361	10.47
4-8-0	305	8.11
8-8-4	380	6.49
6-8-4	375	8.47
4-6-4	335	9.59
4-4-4	325	9.52
Varying Rate (Analysis 4-8-4)		
1200 lbs	492	8.48
1800 lbs.	460	-1.19
2400 lbs.	457	-9.43
Yield Without Fertilizer		
	387	

The test reported in Table 10 was conducted on fine sandy loam of the Flatwoods soil area on the farm of W. C. Butler near Starkville. The natural fertility of the soil was low as indicated by the yield of 387 pounds of seed cotton per acre without fertilizer. This test was run only one year.

These results are inconsistent as far as nitrogen and phosphorus are concerned. They indicate that a fertilizer for this soil should carry about 6 per cent potash. They indicate that a good fertilizer will produce profitable increases on this soil. Reference should be made to other tests of the Flatwoods soil area to determine a good ratio of phosphoric acid and nitrogen.

TABLE 11—FINE SANDY LOAM—STARKVILLE, THOMAS WOFFORD—1925-26

	INCREASE			PROFIT		
N-P-K	'25	'26	Average	'25	'26	Average
Varying Analysis (Rate 600 Pounds Per Acre)						
4-8-8	485	576	531	24.64	19.79	22.22
4-8-6	635	431	533	35.80	13.01	24.41
4-8-4	471	410	441	24.92	12.43	18.68
4-8-2	355	503	429	17.45	17.55	17.50
4-8-0	199	476	338	7.16	16.67	11.92
8-8-4	646	852	749	33.08	30.11	31.60
6-8-4	453	633	543	21.65	21.36	21.51
4-6-4	360	499	430	17.81	17.52	17.67
4-4-4	296	468	382	14.00	16.69	15.35
Varying Rate (Analysis 4-8-4)						
1200 lbs.	891	824	858	46.85	25.08	35.71
1800 lbs.	928	715	822	40.87	11.52	26.20
2400 lbs.	974	619	797	36.08	-1.32	17.38
Yield Without Fertilizer						
	470	375	423			

The test reported in Table 11 was conducted on fine sandy loam on the farm of Thomas Wofford near Starkville. The land was rolling. It was naturally poor as indicated by the average No Fertilizer yield of 423 pounds of seed cotton per acre.

Nitrogen was very effective in increasing the yield and profit when it was increased from 4 to 6 per cent and from 6 to 8 per cent.

Phosphoric acid increased the yield and profit slightly when increased from 4 to 6 per cent and from 6 to 8 per cent.

Potash was very profitable when used up to 6 per cent.

These results indicate that an 8-8-6 will probably be the most profitable fertilizer to use on this soil.

1200 pounds per acre was almost twice as profitable as 600 pounds.

Summary of the Flatwoods Tests

		Years
Table 7—Clay—Starkville	6 - 8 -4	4
Tables 8 and 9—Fine Sandy Loam—Longview	8 - 8 -0	4
Table 11—Fine Sandy Loam—Starkville	8 - 8 -6	2
Table 10—Fine Sandy Loam—Starkville	(?) - (?) -6	1

These results indicate that approximately equal quantities of phosphoric acid and nitrogen will probably be the most profitable ratio of these two plant foods, and that potash is usually needed. An 8-8-4 will probably be the most profitable analysis to use over the area as a whole. If factory mixed fertilizers are to be used and the desired analysis cannot be bought, the analysis can be changed easily by adding nitrogen, phosphoric acid, or potash.

Shortleaf Pine, Northeast Highland, and Pontotoc Ridge Soil Areas

There is sufficient similarity between the soils of the Shortleaf Pine, Northeast Highland, and the Pontotoc Ridge and their response to fertilizers to group the results reported for these soil areas.

The Shortleaf Pine soil area extends from the Tennessee line to the Alabama line at Lauderdale and Clarke Counties. It is bordered on the east by the Flatwoods, on the west by the Brown Loam, and on the south by the Central Prairie. The principal soil class found in the Shortleaf Pine soil area is fine sandy loam, but there are all gradations of soil classes, from a stiff clay to very sandy soils.

The Northeast Highland soil area is in the extreme northeast portion of the state and immediately east of the Northeast Prairie. The principal soil class found in this area is fine sandy loam, but there are all gradations of soil classes between almost pure clays to almost pure sands.

The Pontotoc Ridge soil area is a triangular soil area which extends from Houston in Chickasaw County to the Tennessee line. It lies between the Northeast Prairie and the Flatwoods soil areas. The soils of this area are mostly reddish clays and sandy loams.

TABLE 12—SANDY LOAM—CHOCTAW, WEIR, J. B. RAY—1925-26-27

	INCREASE				PROFIT			
N-P-K	'25	'26	'27	Average	'25	'26	'27	Average
				Varying Analysis (Rate 600 Pounds Per Acre)				
4-8-8	495	523	610	542	24.89	17.11	53.39	25.13
4-8-6	469	470	582	507	24.18	14.96	51.97	23.70
4-8-4	388	583	614	528	19.10	21.05	34.83	26.06
4-8-2	419	608	508	511	21.91	22.77	28.01	24.23
4-8-0	363	494	490	449	18.60	17.57	27.33	21.17
8-8-4	575	729	946	750	28.13	23.93	53.43	35.16
6-8-4	688	808	860	785	38.10	30.12	49.73	39.31
4-6-4	556	673	549	593	31.52	26.25	30.86	29.55
4-4-4	453	624	612	563	24.99	24.48	35.84	28.43
				Varying Rate (Analysis 4-8-4)				
1200 lbs.	843	761	1116	907	42.97	21.91	61.84	42.24
1800 lbs.	1029	842	1498	1123	47.97	17.87	80.43	48.75
2400 lbs.	1077	796	1732	1202	43.31	7.55	88.74	46.53
				Yield Without Fertilizer				
	637	831	388	452				

The test reported in Table 12 was conducted on brown sandy loam near Weir on J. B. Ray's farm. The land was level. The soil was not very fertile as indicated by the average No Fertilizer yield of 452 pounds of seed cotton.

Nitrogen increased the yield very profitably when increased from 4 to 6 per cent, but 8 per cent nitrogen did not increase the yield over the 6 per cent.

Phosphoric acid showed a tendency in some cases to increase the yield slightly when more phosphoric acid than nitrogen was used. These results indicate that the phosphoric acid content of a fertilizer probably should not be greater than the nitrogen content for this soil.

The response to potash was inconsistent, but the data indicate that probably 4 per cent is profitable on this soil.

These data indicate that approximately equal quantities of nitrogen and phosphoric acid should be used and that some potash is profitable. The above combination can be obtained from an 8-8-4. Three hundred lbs. of 8-8-4 carries the same amount of nitrogen and phosphoric acid as 600 lbs. of 4-4-4.

TABLE 13—SANDY LOAM—CHOCTAW. WEIR. CLYDE COLEMAN—1925-26-27

	INCREASE				PROFIT			
N-P-K	'25	'26	'27	Average	'25	'26	'27	Average
				Varying Analysis (Rate 600 Pounds Per Acre)				
4-8-8	488	926	918	777	24.91	37.29	54.89	39.03
4-8-6	498	1091	973	824	26.21	41.49	59.37	42.36
4-8-4	446	938	986	788	23.22	38.85	60.48	40.85
4-8-2	485	1136	952	851	26.57	48.21	59.13	44.64
4-8-0	474	1046	957	826	26.41	45.17	59.37	43.65
8-8-4	605	1481	1446	1177	30.23	61.55	88.40	60.06
6-8-4	624	1332	1304	1087	33.60	56.32	80.81	56.91
4-6-4	546	991	1018	850	30.44	42.14	63.66	45.42
4-4-4	489	957	1001	816	27.53	41.11	63.10	43.91
				Varying Rate (Analysis 4-8-4)				
1200 lbs.	673	1481	1458	1204	31.08	57.89	85.77	58.25
1800 lbs.	845	1735	1779	1460	35.11	68.54	100.16	66.27
2400 lbs.	929	1787	1877	1531	32.94	57.06	98.86	62.96
				Yield Without Fertilizer				
	533	341	320	398				

Table 13 gives the results of a test on gray sandy loam soil on Clyde Coleman's farm near Weir. The average No Fertilizer yield was 398 lbs per acre.

Nitrogen increased the yield and profit when increased from 4 to 6% and from 6 to 8%, but the increase from 4 to 6% was very much larger than from 6 to 8%

Phosphoric acid increased the yield and profit very slightly when increased from 4 to 6%, but the yield for 8% was less. The increase produced by 1200 pounds of 4-8-4 was about the same as produced by 600 pounds of 8-8-4. They carry the same amount of nitrogen and the 1200 pounds of 4-8-4 has twice as much phosphorus and potash. Therefore, the additional phosphoric acid was not very efficient. These results indicate that the phosphoric acid should not be used in greater quantities than the nitrogen on this soil.

Potash did not increase the yields profitably in this test.

These results indicate that equal quantities of phosphoric acid and nitrogen is the most profitable ratio to use on this soil. This ratio can be obtained from an 8-8-0. Three hundred pounds of an 8-8-0 contains as much nitrogen and phosphoric acid as the 600 pounds of 4-4-4.

TABLE 14—CLAY LOAM—WEBSTER. EUPORA. FRANK FERGUSON—1926-27-28

	INCREASE				PROFIT			
N-P-K	'26	'27	'28	Average	'26	'27	'28	Average
				Varying Analysis (Rate 600 Pounds Per Acre)				
4-8-8	377	413	359	383	9.81	19.59	13.05	14.15
4-8-6	449	499	436	431	18.91	19.89	18.15	17.32
4-8-4	427	428	481	445	13.25	21.82	21.39	18.82
4-8-2	483	464	544	497	16.52	24.91	25.70	22.38
4-8-0	431	400	427	419	14.42	21.07	19.18	18.22
8-8-4	595	645	795	678	17.23	32.34	36.10	28.56
6-8-4	541	544	646	577	16.77	27.57	29.19	24.51
4-6-4	507	473	468	483	17.75	25.54	21.18	21.49
4-4-4	458	458	531	482	16.18	25.02	25.50	22.23
				Varying Rate (Analysis 4-8-4)				
1200 lbs.	635	620	661	639	15.60	27.12	24.74	22.49
1800 lbs.	772	751	830	784	14.37	28.14	27.42	23.31
2400 lbs.	739	723	784	746	4.25	18.11	17.20	13.19
				Yield Without Fertilizer				
	716	421	243	460				

The test reported in Table 14 was conducted on white clay "crawfishy" soil near Eupora on Frank Ferguson's farm. This land was not very well drained. The average No Fertilizer yield of seed cotton was 460 pounds per acre.

Nitrogen increased the yield and profit very much when increased from 4 to 6 per cent and considerably when increased from 6 to 8 per cent.

Phosphoric acid decreased the profit when increased from 4 to 6 per cent and from 6 to 8 per cent. The 600 pounds of 8-8-4 carried as much nitrogen and one-half as much phosphoric acid and potash as did the 1200 pounds of 4-8-4, and the yield from the 600 pounds of 8-8-4 was greater than from the 1200 pounds of 4-8-4. These results indicate that to increase the phosphoric acid content of the fertilizer over the nitrogen content for this soil is not profitable and at the same time it may be harmful.

Potash increased the yield profitably only one time out of four, which is insignificant; but the No Potash plot was very much harder to pick.

These results indicate that probably an 8-8-0 is the most profitable analysis to use on this soil.

TABLE 15—CLAY LOAM—WEBSTER, EUPORA, J. B. HARDEE—1926-27

	INCREASE			PROFIT		
N P K	'26	'27	Average	'26	27	Average
			Varying Analysis (Rate 600 Pounds Per Acre)			
4-8-8	636	762	699	22.78	44.09	33.43
4-8-6	554	898	726	19.15	54.12	36.63
4-8-4	559	774	667	19.88	46.08	32.98
4-8-2	461	573	517	15.42	32.57	23.99
4-8-0	473	428	450	16.49	23.05	19.77
8-8-4	669	700	685	20.96	36.22	28.59
6-8-4	619	741	680	20.67	41.42	31.04
4-6-4	474	767	620	16.28	46.10	31.19
4-4-4	400	788	594	13.26	48.15	30.70
			Varying Rate (Analysis 4-8-4)			
1200 lbs.	695	1183	939	18.62	66.54	42.58
1800 lbs.	783	1198	991	14.97	59.49	37.23
2400 lbs.	863	1392	1128	10.91	64.93	37.92
			Yield Without Fertilizer			
	586	617	601			

Table 15 gives the results of a test conducted on clay loam bottom land on the farm of J. B. Hardee near Eupora. The average yield of 601 pounds of seed cotton per acre without fertilizer indicates that the soil is naturally productive.

Nitrogen, when increased from 4 to 6 or 8 per cent, increased the yields slightly, but not profitably.

Phosphoric acid increased the yields and profits only slightly when increased from 4 to 6 and to 8 per cent. The difference in the yield of the 600 pounds of 8-8-4 and the 1200 pounds of 4-8-4 indicates that more phosphoric acid and potash than nitrogen may be profitable on this soil when high rates are used.

When 6 per cent potash was used, the profit was nearly double the profit with no potash .

These results indicate that approximately equal quantities of nitrogen, phosphoric acid, and potash will probably be the most profitable combination for this soil when 600 pounds or less is used per acre. An 8-8-8 will furnish the above ratio. Three hundred pounds of 8-8-8 contains as much nitrogen, phosphorus and potash as the 600 pounds of 4-4-4.

TABLE 16—(A)—SANDY LOAM—CHOCTAW, ACKERMAN, J. C. CORK—1925.
(B)—SANDY—LOWNDES, COLUMBUS, W. H. OTLEY—1927

N-P-K	A—ACKERMAN, 1925		B—COLUMBUS, 1927	
	Increase	Profit	Increase	Profit
	Varying Analysis (Rate 600 Pounds Per Acre)			
4-8-8	547	29.01	380	17.27
4-8-6	550	29.86	478	24.79
4-8-4	445	23.15	394	19.48
4-8-2	432	22.84	406	20.92
4-8-0	431	23.42	257	11.03
8-8-4	611	30.60	487	21.54
6-8-4	746	42.16	479	23.11
4-6-4	536	30.18	395	20.08
4-4-4	465	25.85	396	20.79
	Varying Rate (Aanalysis 4-8-4)			
1200 lbs.	773	38.05	543	21.77
1800 lbs.	956	43.83	626	19.48
2400 lbs.	960	35.13	534	11.89
	Yield Without Fertilizer			
	1403		477	

The results of two one-year tests are given in Table 16. Test A was conducted on sandy loam soil near Ackerman on J. C. Cork's farm. Test B was conducted on sandy soil near Columbus on W. H. Otley's farm.

Test A—Ackerman

Nitrogen was more profitable when 6 per cent was used than when 4 or 8 per cent was used.

Phosphoric acid increased the yield and profit very much when increased from 4 to 6 per cent, but they were smaller when 8 per cent was used.

Potash was profitable twice out of four times.

Test B—Columbus

Nitrogen was more profitable when 6 per cent was used than when 4 or 8 per cent was used.

Phosphoric acid, when increased from 4 to 6 or 8 per cent did not increase the yield. The data indicate that no more phosphoric acid than nitrogen should be used.

When 6 per cent potash was used, the profit was double that where no potash was used.

These data in Test B indicate that equal parts of nitrogen, phosphoric acid, and potash will probably be the most profitable ratio to use on this soil. An 8-8-8 will furnish the above ratio.

TABLE 17—SANDY LOAM—LOWNDES, COLUMBUS, W. M. BELL—1929-30

Rate	N-P-K	INCREASE '29	INCREASE '30	INCREASE Average	PROFIT '29	PROFIT '30	PROFIT Average
600 lbs.	6-0-0	536	213	374	26.13	1.56	13.85
600 lbs.	6-8-0	745	372	559	36.03	4.48	20.26
600 lbs.	6-8-4	784	469	627	37.25	6.71	21.98
600 lbs.	6-8-8	730	586	658	32.86	9.66	21.26
600 lbs.	6-12-4	835	496	666	38.98	6.35	22.67
600 lbs.	6-4-4	701	388	545	33.60	5.23	19.42
600 lbs.	4-8-4	597	363	480	28.03	4.97	16.50
300 lbs.	6-8-4	493	316	405	24.70	6.20	15.45
900 lbs.	6-8-4	1044	675	860	47.95	9.09	28.52
		Yield Without Fertilizer					
		296	359	328			

The results of one of the new tests which was conducted on brown sandy loam near Columbus on W. M. Bell's farm are reported in Table 17. The average No Fertilizer yield was 328 pounds of seed cotton per acre.

Nitrogen alone, when 600 pounds of 6-0-0 was used, gave an average profit of $13.85. When phosphorus and potash were used, 6 per cent nitrogen was more profitable than 4 per cent.

Phosphoric acid (8 per cent), when used in addition to nitrogen in the

600 pound rate, increased the profit more than $6 per acre. Increasing the phosphoric acid from 8 to 12 per cent resulted in a comparatively small increase in the profit.

Potash (4 per cent) made a comparatively small increase in the profit.

These results indicate that a 6-8-(?) is probably the most profitable analysis for this soil.

TABLE 18—FINE SANDY LOAM—NOXUBEE, MACON, CIRCLE M.—1929-30

Rate	N-P-K	INCREASE '29	INCREASE '30	INCREASE Average	PROFIT '29	PROFIT '30	PROFIT Average
600 lbs.	6-0-0	239	222	231	8.32	1.90	5.11
600 lbs.	6-8-0	366	405	385	13.27	5.62	9.45
600 lbs.	6-8-4	470	438	454	18.40	5.63	12.02
600 lbs.	6-12-4	497	486	492	18.68	6.00	12.34
300 lbs.	6-8-4	309	245	277	13.62	3.72	8.67
900 lbs.	6-8-4	543	456	499	17.84	1.42	9.63
		Yield Without Fertilizer					
		645	476	561			

TABLE 19—NOXUBEE, MACON, CIRCLE M—1929

Rate	FINE SANDY LOAM N-P-K	FINE SANDY LOAM Increase '29	FINE SANDY LOAM Profit '29	RED CLAY LOAM N-P-K	RED CLAY LOAM Increase '29	RED CLAY LOAM Profit '29
600 lbs.	6-0-0	412	18.69	6-0-0	558	27.50
600 lbs.	6-8-0	442	17.88	6-8-0	592	26.87
600 lbs.	6-8-4	441	16.64	6-8-4	548	23.08
600 lbs.	6-8-8	451	16.09	6-12-4	572	23.15
600 lbs.	6-12-4	466	16.81			
600 lbs.	6-4-4	449	18.45			
600 lbs.	4-8-4	272	8.53			
300 lbs.	6-8-4	279	11.83	6-8-4	298	12.96
900 lbs.	6-8-4	549	18.25	6-8-4	702	27.41
		Yield Without Fertilizer				
		537			230	

The results of two small tests on fine sandy loam and one on red clay loam at Circle M Plantation near Macon are reported in Tables 18 and 19.

The results reported in table 18 indicate that nitrogen, phosphorus, and potash are needed on this soil and that a 6-8-4 is a good analysis. Increasing the phosphoric acid from 8 to 12 per cent is probably not as profitable as adding the same value of 6-8-4. Six hundred pounds was more profitable than 300 pounds or 900 piunds.

Nitrogen made very profitable increases in both tests, (table 19) but addition of phosphoric acid and potash did not make profitable increases.

TABLE 20—GLADE LAND—NOXUBEE, MACON, CIRCLE M—1929

Rate	N-P-K	INCREASE '29	PROFIT '29
600 lbs.	0-0-4	226	12.18
600 lbs.	0-0-8	362	19.42
600 lbs.	0-8-4	218	9.24
600 lbs.	0-8-8	490	23.44
600 lbs.	0-8-12	426	18.45
600 lbs.	4-8-12	436	15.05
600 lbs.	4-8-8	330	10.81
600 lbs.	4-8-4	90	-2.41
600 lbs.	4-8-0	-22	-7.95
600 lbs.	4-0-8	263	9.48
300 lbs.	4-8-8	111	2.18
900 lbs.	4-8-8	351	7.62
	Yield Without Fertilizer		
		219	

The results of a test on sandy loam glade land at Circle M Plantation near Macon are reported in Table 20. The yield without fertilizer was only 219 pounds of seed cotton per acre.

Nitrogen and phosphorous were not consistent, but usually they did not make profitable increases.

Potash was very profitable up to 48 pounds per acre.

TABLE 21—SANDY LOAM—UNION, NEW ALBANY, D. W. ROBINS—1926-27

N P-K	INCREASE '26	INCREASE '27	INCREASE Average	PROFIT '26	PROFIT '27	PROFIT Average
Varying Analysis (Rate 600 Pounds Per Acre)						
4-8-8	420	647	534	16.19	35.99	26.09
4-8-6	492	529	511	15.48	28.27	21.88
4-8-4	440	516	478	13.54	27.99	20.77
4-8-2	407	375	391	12.56	18.69	15.63
4-8-0	346	382	364	10.14	19.81	14.98
8-8-4	661	660	661	20.14	33.40	26.77
6-8-4	693	579	636	23.92	30.05	26.99
4-6-4	465	322	394	15.43	14.97	15.20
4-4-4	479	360	415	16.39	18.22	17.31
Varying Rate (Analysis 4-8-4)						
1200 lbs	896	577	736	27.83	24.13	25.98
1800 lbs	1065	688	847	24.87	23.78	24.33
2200 lbs.	1051	770	911	18.69	21.35	20.02

The test reported in Table 21 was conducted on sandy loam soil by the Holly Springs Experiment Station workers near New Albany on the farm of D. W. Robins.

Nitrogen increased the profit very much when increased from 4 to 6 per cent.

The results for phosphoric acid are inconsistent, but they indicate that phosphoric acid should be used in an amount not greater than that of the nitrogen.

The increases for the use of potash are not regular, but they indicate that high potash fertilizers are probably the most profitable.

These data indicate that the most profitable analysis fertilizer for this soil is probably an 8-8-8 or 6-6-6, which carry equal amounts of the three fertilizer elements. Three hundred pounds of 8-8-8 carries as much nitrogen, phosphorous and potash as 600 pounds of 4-4-4.

Summary of Shortleaf Pine, Northeast Highland and Pontotoc Ridge Tests

		Years
Table 12—Sandy Loam—Weir	8 - 8 - 4	3
Table 13—Sandy Loam—Weir	8 - 8 - 0	3
Table 14—Clay—Eupora	8 - 8 - 0	3
Table 15—Clay loam—Eupora	8 - 8 - 0	2
Table 16B—Sandy—Columbus	8 - 8 - 8	1
Table 17—Sandy loam—Columbus	6 - 8-(?)*	2
Table 18—Fine sandy loam—Macon	6 - 8 - 4 *	1
Table 19—Red clay—Macon	6 - 0 - 0	1
Table 20—Glade land—Macon	0 - 0 - 8	1
Table 21—Sandy loam—New Albany	8 - 8 - 8	2

*These tests did not have sufficient analyses to determine whether or not the 6-8- was the most profitable ratio of applying nitrogen and phosphoric acid or whether or not equal parts of nitrogen and phosphoric acid would have been more profitable.

These results indicate that equal parts of nitrogen and phosphoric acid will probably be the most profitable ratio to use on the soils of the Shortleaf Pine, Northeast Highland, and Pontotoc Ridge soil areas. If mixed fertilizers are to be used, they should be so altered, if necessary, as to make them approach equal quantities of phosphoric acid and nitrogen. These results indicate that potash is sometimes profitable and, when it is, it usually pays tremendously large profits.

An 8-8-0 will carry the equal ratios of phosphoric acid and nitrogen. Potash should be added by all means where wilt, rust, or leaf diseases occur.

Brown Loam and Loess Soil Area

The Brown Loam and Loess soil area extends through the entire state along the eastern border of the Mississippi River "flood plains." The principal soil class in this area is silt loam. The tests reported for this area were

conducted by the Holly Springs and Raymond Experiment Stations.

TABLE 22—VALLEY LAND—HOLLY SPRINGS STATION—1925-26-27-28-29-30

N-P-K	'25	'26	'27	'28	'29	'30	Average
Varying Analysis (Rate 600 Pounds Per Acre)							
4-8-8 Increase	435	908	372	812	1070	859	743
4-8-8 Profit	21.18	35.60	16.71	40.18	55.24	21.19	31.68
4-8-6 Increase	316	758	265	817	936	696	631
4-8-6 Profit	13.46	28.75	9.85	41.01	47.80	16.06	26.14
4-8-4 Increase	586	538	244	595	821	589	562
4-8-4 Profit	33.00	18.41	8.96	28.23	41.47	12.89	23.83
4-8-2 Increase	258	363	319	270	553	488	372
4-8-2 Profit	9.25	10.36	14.79	9.24	25.93	9.91	13.25
4-8-0 Increase	170	115	269	61	172	197	164
4-8-0 Profit	5.13	-1.40	11.87	-2.78	1.66	0.32	2.47
8-8-4 Increase	361	524	250	458	789	639	503
8-8-4 Profit	13.11	13.19	4.70	15.87	35.55	10.70	15.52
6-8-4 Increase	475	519	382	597	709	633	562
6-8-4 Profit	23.20	15.26	16.24	26.25	32.72	12.45	21.02
4-6-4 Increase	471	373	285	533	686	603	492
4-6-4 Profit	25.60	10.85	12.35	25.09	34.00	14.05	20.32
4-4-4 Increase	423	291	274	393	476	554	402
4-4-4 Profit	22.91	7.44	12.20	17.22	22.09	12.97	15.81
Varying Rate (Analysis 4-8-4)							
1200 lbs. Increase	774	738	433	760	791	782	713
1200 lbs. Profit	38.14	19.95	14.04	30.69	31.83	12.38	24.51
1800 lbs. Increase	739	834	167	894	1012	959	767
1800 lbs. Profit	27.65	16.28	-12.69	31.24	37.30	11.11	18.48
2400 lbs. Increase	484	1058	99	1081	1197	1061	830
2400 lbs. Profit	1.80	19.02	-25.60	35.09	40.55	7.18	12.99
Yield Without Fertilizer							
	1561	1213	824	786	763	714	977

The test reported in Table 22 was conducted on fertile valley land near Holly Springs by the Holly Springs Experiment Station. This land had been improved for several years by the use of legumes. The average yield of 977 pounds of seed cotton per acre indicates that this piece of land is naturally fertile. The yields without fertilizer have decreased each year since 1925. The 1930 yield without fertilizer was less than half that of 1925. The increases from 600 pounds of 4-8-8 have exhibited a tendency to increase since 1925.

Nitrogen usually did not increase the yield when it was increased from 4 to 6 or 8 per cent. It is not certain whether or not 4 per cent nitrogen paid in this test.

Phosphoric acid increased the yield profitably when increased from 4 to 6 per cent and from 6 to 8 per cent.

Potash increased the yield very profitably with each 2 per cent increase when it was increased from 0 to 8 per cent.

These results indicate that a 4-8-8 is probably the most profitable analysis to use on this soil.

The test reported in Table 23 was conducted on brown loam hill land near Holly Springs by the Holly Springs Experiment Station. The yield without fertilizer was 633 pounds of seed cotton per acre.

When the nitrogen was increased from 6 to 8 per cent, there was a profitable increase in the yield. The 4 per cent nitrogen produced a larger increase and net profit than 6 or 8 per cent.

Phosphoric acid produced a small increase when increased from 4 to 6 per cent and a larger increase from 6 to 8 per cent, which is not consistent.

Potash was very profitable when used up to 6 per cent.

These results indicate that the most profitable ratio of nitrogen, phosphoric acid, and potash for this soil is probably equal parts of each. An 8-8-8 analysis will furnish this ratio.

TABLE 23—HILL LAND—HOLLY SPRINGS STATION—1925-26-27-28-29

N-P-K	'25	'26	'27	'28	'29	Average
Varying Analysis (Rate 600 Pounds Per Acre)						
4-8-8 Increase	541	892	691	388	516	606
4-8-8 Profit	28.63	34.78	39.05	14.79	22.00	27.85
4-8-6 Increase	542	1083	673	414	472	637
4-8-6 Profit	29.28	45.02	38.35	16.88	19.94	29.89
4-8-4 Increase	465	1011	748	328	426	595
4-8-4 Profit	24.53	42.08	44.20	12.21	17.75	28.15
4-8-2 Increase	238	782	515	310	424	454
4-8-2 Profit	9.23	31.28	28.50	11.68	18.21	19.78
4-8-0 Increase	190	486	613	200	354	369
4-8-0 Profit	6.56	17.17	35.98	5.58	14.58	15.97
8-8-4 Increase	292	1093	701	314	402	560
8-8-4 Profit	8.31	41.75	36.26	7.24	12.31	21.17
6-8-4 Increase	272	494	645	303	455	434
6-8-4 Profit	8.97	13.99	34.67	8.63	17.49	16.75
4-6-4 Increase	264	498	651	235	384	406
4-6-4 Profit	11.09	17.12	37.97	7.22	15.89	17.86
4-4-4 Increase	281	446	481	220	343	354
4-4-4 Profit	12.99	15.19	26.69	6.85	14.10	15.16
Varying Rate (Analysis 4-8-4)						
1200 lbs. Increase	622	703	924	495	584	666
1200 lbs. Profit	27.52	18.22	48.41	14.76	19.39	25.66
1800 lbs. Increase	801	905	1038	496	613	771
1800 lbs. Profit	32.00	19.86	48.26	7.36	13.34	24.16
2400 lbs. Increase	985	946	1035	542	637	829
2400 lbs. Profit	36.88	13.45	39.95	2.70	6.94	19.98
Yield Without Fertilizer	680	609	672	562	642	633

TABLE 24—BROWN LOAM—HOLMES, DURANT, C. H. McCLELLAN—1925-26

N-P-K	INCREASE '25	INCREASE '26	INCREASE Average	PROFIT '25	PROFIT '26	PROFIT Average
Varying Analysis (Rate 600 Pounds Per Acre)						
4-8-8	212	780	496	5.58	29.17	17.38
4-8-6	272	656	464	10.36	23.67	17.02
4-8-4	467	696	582	24.65	26.31	25.48
4-8-2	608	526	567	35.13	18.51	26.82
4-8-0	409	300	355	21.86	7.87	14.87
8-8-4	446	666	556	19.05	20.42	19.74
6-8-4	567	600	584	29.62	19.30	24.46
4-6-4	533	267	400	29.92	5.53	17.73
4-4-4	509	250	380	28.91	5.38	17.15
Varying Rate (Analysis 4-8-4)						
1200 lbs.	533	500	517	21.25	8.08	14.67
1800 lbs.	582	580	581	16.65	3.61	10.13
2400 lbs.	636	667	652	12.45	-0.52	5.97

The test reported in Table 24 was conducted on slightly rolling brown loam soil near Durant on the farm of C. H. McClellan by the Holly Springs Experiment Station.

Nitrogen did not increase the yield when increased above 4 per cent.

Phosphoric acid did not increase the yield significantly when increased from 4 to 6 per cent, but gave a highly profitable increase in yield when increased from 6 to 8 per cent. This made the 4-8-4 analysis much more profitable than either the 4-4-4 or 8-8-4, indicating that the phosphoric acid content should be in excess of the nitrogen. This evidence is contradicted when 600 pounds of 8-8-4 is compared with 1200 pounds of 4-8-4. If the above assumption that phosphorus is profitable were true, we should expect a greater increase from 1200 pounds of 4-8-4 than from 600 pounds of 8-8-4, since it carries twice as much phosphorus. As a matter of fact, a smaller increase was obtained. This contradiction in the data makes one inclined to doubt the accuracy of the increase obtained from the 4-8-4 analysis and conclude that approximately equal parts of nitrogen and phosphoric acid give the best ratio between these elements.

Potash was inconsistent in producing increases, but the indications are that some potash will pay on this soil.

These results indicate that approximately equal quantities of nitrogen and phosphoric acid will likely be the most profitable combination. An 8-8-4 will furnish this ratio.

TABLE 25—BROWN LOAM—HINDS, RAYMOND STATION—1925-26-27-28-29-30

N-P-K	'25	'26	'27	'28	'29	'30	Average
Varying Analysis (Rate 600 Pounds Per Acre)							
4-8-8 Increase	374	516	759	483	411	500	507
4-8-8 Profit	16.88	15.99	43.76	24.50	19.44	8.17	21.46
4-8-6 Increase	255	470	657	551	507	510	492
4-8-6 Profit	9.17	14.36	37.26	29.82	26.76	9.12	21.08
4-8-4 Increase	224	425	499	401	536	399	414
4-8-4 Profit	7.68	12.78	26.76	19.91	29.39	5.83	17.06
4-8-2 Increase	311	470	519	323	462	384	412
4-8-2 Profit	14.38	15.69	28.82	15.09	24.81	5.91	17.45
4-8-0 Increase	351	383	287	247	241	198	285
4-8-0 Profit	17.80	12.00	13.12	10.38	9.94	.00	10.54
8-8-4 Increase	493	696	688	545	593	646	610
8-8-4 Profit	22.40	21.92	35.33	25.34	28.70	9.80	23.92
6-8-4 Increase	464	507	605	579	583	601	557
6-8-4 Profit	22.39	14.67	31.84	30.03	30.34	10.57	23.31
4-6-4 Increase	510	562	543	481	477	550	521
4-6-4 Profit	28.33	20.30	30.44	26.07	25.82	11.68	23.77
4-4-4 Increase	303	424	528	467	562	503	465
4-4-4 Profit	14.48	14.08	29.92	25.68	32.34	10.61	21.19
Varying Rate (Analysis 4-8-4)							
1200 lbs. Increase	638	657	938	846	1061	992	855
1200 lbs. Profit	28.59	15.90	49.42	42.99	58.01	18.46	35.56
1800 lbs. Increase	828	1162	1101	924	1127	966	1018
1800 lbs. Profit	33.88	32.70	52.65	40.30	54.50	9.42	37.24
2400 lbs. Increase	741	1330	1056	1273	1242	1090	1122
2400 lbs. Profit	19.76	32.62	41.38	56.57	54.42	5.63	35.06
Yield Without Fertilizer							
	1465	1021	901	544	756	976	944

The test reported in Table 25 was conducted on fertile bottom soil of the Brown Loam area near Raymond by the Raymond Experiment Station. The average yield without fertilizer was 944 pounds per acre.

The results are contradictory, but they indicate that fertilizers make very profitable increases on this soil. They indicate that probably the potash content of the fertilizer should be as high as the phosphoric acid content.

TABLE 26—BROWN LOAM—JEFFERSON, FAYETTE, JEFF TRULY—1926

N-P-K	Increase	Profit
Varying Analysis (Rate 600 Pounds Per Acre)		
4-8-8	445	12.42
4-8-6	435	12.61
4-8-4	478	15.41
4-8-2	459	15.13
4-8-0	335	9.62
8-8-4	598	16.99
6-8-4	590	18.83
4-6-4	368	10.58
4-4-4	353	10.52
Varying Rate (Aanalysis 4-8-4)		
1200 lbs.	579	12.02
1800 lbs.	948	22.00
2400 lbs.	1212	26.74
Yield Without Fertilizer		
	544	

The test reported in Table 26 was conducted on brown loam soil near Fayette on Jeff Truly's farm. The yield without fertilizer was 544 pounds of seed cotton per acre. This test was run only one year.

Nitrogen increased the yield profitably when increased from 4 to 6 per cent, but not when increased from 6 to 8 per cent.

Phosphoric acid did not produce a profitable increase when increased from 4 to 6 per cent, but the 8 per cent shows an increase which, when compared with the analyses near it, appears to be contradictory.

Potash produced inconsistent increases and profits.

These results indicate that equal parts of nitrogen and phosphoric acid will probably be the most profitable ratio of these elements, and that an equal rate of potash is probably the most profitable. The above ratio can be obtained from an 8-8-8. Three hundred pounds of 8-8-8 carries as much nitrogen, phosphoric acid, and potash as the 600 pounds of 4-4-4.

Summary of the Brown Loam and Loess Tests

		Years
Table 22—Fertile bottom land—Holly Springs	4 8 8	5
Table 23—Hill land—Holly Springs	6 8 8	1
Table 24—Hill land—Durant	8 8 4	2
Table 26—Hill land—Fayette	8 8 4	1

These results indicate that nitrogen and phosphoric acid should be used in approximately equal quantities on the hill lands of the Brown Loam area and that twice as much phosphoric acid as nitrogen should be used on the fertile bottom lands. Potash was usually very profitable on these soils.

Longleaf Pine Soil Area

The Longleaf Pine soil area is bordered on the north by the Central Prairie, on the south by the Gulf Coastal, and on the west by the Brown Loam and Loess soil areas. The main soil classes of the hill soils of this area are gray and brown sandy loams. The Poplarville Experiment Station conducted the tests reported below.

TABLE 27—SOUTH MISSISSIPPI—PEARL RIVER COUNTY, POPLARVILLE—'25-26-27-28-29-30

N P K	'25	'26	'27	'28	'29	'30	Average
Varying Analysis (Rate 600 Pounds Per Acre)							
4 8 8 Increase	372	200	553	205	673	311	386
4 8 8 Profit	16.78	-0.18	29.40	3.76	31.42	1.56	13.85
4 8 6 Increase	415	324	573	435	885	331	494
4 8 6 Profit	20.87	7.03	31.34	18.14	43.72	2.86	20.66
4 8 4 Increase	520	307	603	449	643	292	469
4 8 4 Profit	28.40	6.89	34.06	19.46	30.77	2.09	20.28
4 8 2 Increase	654	424	750	459	777	213	546
4 8 2 Profit	38.40	13.39	44.99	20.62	39.39	-0.07	26.12
4 8 0 Increase	673	302	568	374	553	107	430
4 8 0 Profit	40.33	7.94	32.79	16.02	26.59	-3.18	20.07
8 8 4 Increase	750	332	665	454	574	216	498
8 8 4 Profit	40.33	3.72	33.72	15.63	22.63	-5.25	18.46
6 8 4 Increase	581	503	731	109	760	158	457
6 8 4 Profit	30.60	4.46	40.66	2.20	35.79	-5.64	18.01
4 6 4 Increase	432	282	587	142	695	216	392
4 6 4 Profit	22.85	6.27	33.52	1.17	29.15	-.01	15.49
4 4 4 Increase	365	257	437	125	495	116	299
4 4 4 Profit	18.86	5.74	23.55	1.15	23.22	-1.54	11.83
Varying Rates (Anaysis 4-8-4)							
1200 lbs. Increase	788	463	657	614	1046	53	604
1200 lbs. Profit	39.10	6.23	29.71	21.92	47.14	-14.40	21.62
1800 lbs. Increase	802	513	657	693	1142	256	677
1800 lbs. Profit	32.08	0.22	21.56	19.22	45.08	-15.43	17.12
2400 lbs. Increase	663	505	653	801	848	181	609
2400 lbs. Profit	14.34	-8.62	13.21	18.23	19.63	-26.18	5.10
Yield Without Fertilizer							
	1272	816	352	352	827	910	755

The test reported in Table 27 was conducted at Poplarville by the Poplarville Experiment Station. The average No Fertilizer yield was 755 pounds of seed cotton per acre.

Nitrogen did not increase the yield profitably when increased from 4 to 6 or 8 per cent.

Phosphoric acid increased the yield very profitably when increased from 4 to 6 and from 6 to 8 per cent.

Potash produced a profitable increase only one time out of four when the six-year average is considered. An inspection of the data by years reveals the fact that potash has become more effective as cropping to cotton was continued, which leads one to the conclusion that potash is profitable after a few years of continuous cotton.

These results indicate a 4-8-4 analysis for this soil.

TABLE 28—SOUTH MISSISSIPPI—LAMAR COUNTY. PURVIS. E. F. SAYE—1926-27

N-P-K	INCREASE '26	'27	Average	PROFIT '26	'27	Average
Varying Analysis (Rate 600 Pounds Per Acre)						
4-8-8	214	458	336	0.88	22.69	11.79
4-8-6	203	390	297	0.98	18.57	9.78
4-8-4	251	443	347	4.09	22.84	13.47
4-8-2	128	480	304	-1.43	26.07	12.32
4-8-0	180	405	293	1.87	21.42	11.65
8-8-4	353	555	454	4.73	26.04	15.39
6-8-4	315	461	388	5.07	21.82	13.45
4-6-4	285	503	394	6.45	27.60	17.03
4-4-4	330	439	385	9.38	23.71	16.55
Varying Rate (Analysis 4-8-4)						
1200 lbs.	368	645	507	1.44	28.89	15.17
1800 lbs.	435	630	533	-3.65	19.71	8.03
2400 lbs.	398	645	522	-13.99	12.63	-0.68
Yield Without Fertilizer						
	795	810	803			

The test reported in Table 28 was conducted near Purvis by the Poplarville Experiment Station. The average No Fertilizer yield was 803 pounds of seed cotton per acre.

Nitrogen was slightly more profitable when 8 per cent was used than when 6 per cent was used, but the 4 per cent nitrogen plot was as profitable as the 6 per cent, which indicates that the results are inconsistent.

Phosphoric acid produced a slight increase in profit when increased from 4 to 6 per cent, but the 8 per cent did not produce as much as either the 4 or 6 per cent. The 1200 pounds of 4-8-4 contains as much nitrogen and twice as much phosphorus and potash as 600 pounds of 8-8-4, and yet the yield for the 1200 pounds of 4-8-4 was only slightly greater, which is additional evidence that the phosphorus is not very profitable when increased above the nitrogen content.

Potash was inconsistent in its effects on the yields, but the increases show a very small profit for potash.

These results indicate that equal parts of nitrogen and phosphoric acid will probably be the most profitable fertilizer for this soil. This ratio can be obtained from an 8-8-0.

Three hundred pounds of 8-8-0 per acre (judging from 600 pounds of 4-4-4) will probably be the most profitable rate.

The test reported in Table 29 was conducted in Pike County by the Poplarville Experiment Station. The No Fertilizer yield was 475 pounds of seed cotton per acre.

Nitrogen was probably not profitable when increased over 4 per cent.

Phosphoric acid usually did not show very profitable increases in the yield when it was increased over the nitrogen content. The 1200 pounds of 4-8-4 contains as much nitrogen and twice as much phosphorous and potash as the 600 pounds of 8-8-4 and, when it is considered that potash greatly increases the yield, very little of the difference in yield of these two fertilizers can be attributed to phosphorus.

TABLE 29—SOUTH MISSISSIPPI—PIKE COUNTY. G. H. ALFORD—1926-27-28

N-P-K	INCREASE '26	'27	'28	Average	PROFIT '26	'27	'28	Average
Varying Analysis (Rate 600 Pounds Per Acre)								
4-8-8	595	467	852	638	19.94	23.33	42.61	28.63
4-8-6	750	560	875	728	28.36	30.47	44.52	34.45
4-8-4	655	647	858	720	24.28	37.14	44.02	35.15
4-8-2	425	645	675	582	13.45	37.62	33.57	28.21
4-8-0	410	523	730	554	13.37	29.70	37.39	26.82
8-8-4	665	675	915	752	20.36	34.44	43.28	32.69
6-8-4	518	645	1063	742	15.19	34.68	54.24	34.70
4-6-4	465	530	735	577	15.45	29.53	37.20	27.39
4-4-4	523	622	707	617	19.00	36.52	36.09	30.54
Varying Rate (Analysis 4-8-4)								
1200 lbs.	958	993	1305	1085	30.95	55.27	63.38	49.20
1800 lbs.	935	907	1520	1121	21.35	39.08	68.82	43.08
2400 lbs.	843	927	1575	1115	8.26	32.35	64.66	35.09
Yield Without Fertilizer								
	609	375	440	475				

Potash produced very profitable increases, but it was inconsistent in the amount of the increase.

These results indicate that equal amounts of nitrogen, phosphoric acid, and potash will probably be the most desirable combination to use on this soil. This combination can be obtained from an 8-8-8. Three hundred pounds of 8-8-8 contains as much nitrogen, phosphorus and potash as 600 pounds of 4-4-4.

TABLE 30—SOUTH MISSISSIPPI—FORREST COUNTY. T. E. McCARDLE—1926-27-28-29

N-P-K	'26	'27	'28	'29	Average
Varying Analysis (Rate 600 Pounds Per Acre)					
4-8-8 Increase	362	539	57	249	302
4-8-8 Profit	8.29	28.40	-4.73	5.98	9.49
4-8-6 Increase	358	520	51	428	339
4-8-6 Profit	8.76	27.67	-4.92	17.30	12.20
4-8-4 Increase	354	576	39	446	354
4-8-4 Profit	9.23	32.19	-5.12	18.95	13.81
4-8-2 Increase	427	649	105	563	436
4-8-2 Profit	13.55	37.90	-0.63	26.55	19.34
4-8-0 Increase	188	500	99	592	345
4-8-0 Profit	2.27	28.07	-0.47	28.86	14.68
8-8-4 Increase	431	733	98	666	482
8-8-4 Profit	8.66	38.50	-5.74	28.15	17.39
6-8-4 Increase	358	627	89	558	408
6-8-4 Profit	7.22	23.42	-4.20	23.67	15.03
4-6-4 Increase	367	545	48	469	357
4-6-4 Profit	10.55	30.58	-4.02	20.99	14.53
4-4-4 Increase	350	506	85	462	338
4-4-4 Profit	10.38	28.42	-4.17	21.24	13.97
Varying Rate (Analysis 4-8-4)					
1200 lbs. Increase	515	1121	211	551	600
1200 lbs. Profit	8.82	62.21	-2.26	17.44	21.55
1800 lbs. Increase	613	1067	308	473	615
1800 lbs. Profit	5.25	50.30	-3.90	4.94	14.15
2400 lbs. Increase	603	1096	391	432	631
2400 lbs. Profit	-3.71	44.20	-6.38	-5.33	7.20
Yield Without Fertilizer					
	912	914	272	389	622

The test reported in Table 30 was conducted in Forrest County by the Poplarville Experiment Station. The average yield without fertilizer was 622 pounds of seed cotton per acre.

Nitrogen increased the yield profitably when increased from 4 to 6 per cent and from 6 to 8 per cent.

Phosphoric acid increased the profit slightly when increased from 4 to 6 per cent, but 8 per cent was less profitable than 4 per cent.

Potash showed a profitable increase only one time out of four, which is not considered indicative.

These results indicate that an 8-8-0 is probably the most profitable analysis for this soil. Three hundred pounds 8-8-0 contains as much nitrogen and phosphoric acid as 600 pounds of 4-4-0.

Summary of Longleaf Pine Test

	Years
Table 27—Pearl River County—Experiment Station 4-8-4	6
Table 28—Lamar County 8-8-0	2
Table 29—Pike County 8-8-8	3
Table 30—Forrest County 8-8-0	4

These results indicate that the most profitable ratio of nitrogen and phosphoric acid is probably equal parts of each for these soils, and that potash is sometimes profitable. An 8-8-0 will furnish the above ratio of nitrogen and phosphoric acid. Where mixed fertilizers are to be used, they should be so altered, if necessary, that they conform closely to the 8-8-0 ratio. Potash may be added at the discretion of the farmer, but it usually will be advisable to use potash where wilt, rust, and other diseases exist.

Sources of Material

A study of the sources tests reveals the fact that in most cases there was a wide variation in results from year to year. Whether this was due to weather conditions or to experimental error or both is not known. It is reasonable to believe that the differences in yield between sources are so small that they cannot be measured by so crude an instrument as field plots, unless many repetitions are made and averaged.

TABLE 31—NITROGEN SOURCES

	INCREASE OVER NO NITROGEN						
	1925	1926	1927	1928	1929	1930	Average
		West Point—Clay County					
Nitrate of Soda		58	291	58	236	39	137
Ammonium Sulphate		10	262	181	234	6	138
Leunasalpeter		83	299	116	180	89	153
Calcium Cyanamid		27	254	123	255	29	138
Calcium Nitrate		9	184	5	266	68	107
Urea		11	223	94	176	57	112
		Starkville—Oktibbeha					
Nitrate of Soda					175	167	171
Synthetic Nit. Soda					201	152	176
Cal-Nitro					231	63	147
Calurea					240	101	170
Ammonium Sulphate					74	100	87
		Longview—Oktibbeha					
Nitrate of Soda					327	125	226
Cal-Nitro					289	134	212
Synthetic Nit. Soda					292	101	196
		Holly Springs—Marshall					
							Av. 1926-30
Nitrate of Soda	247	538	393	482	463	380	451
Ammonium Sulphate	202	441	401	479	415	314	410
Leunasalpeter		510	451	423	433	283	420
Calcium Cyanamid	151	175	405	242	341	289	290
Calcium Nitrate	332	425	504	453	417	394	439
Urea	219	485	634	442	372*	321*	451
Cal-Nitro					437	325	
Ammonium Sulphate and Nitrate of soda					383	290	
		Raymond—Hinds—Test 1					
Nitrate of Soda	319	384	143	250	196	114	217
Ammonium Sulphate	271	269	168	253	141	190	204
Leunasalpeter		390	168	171	182	355	253
Calcium Cyanamid	345	42	186	177	102	421	186
Calcium Nitrate	322	249	175	398	253	223	260
Urea	305	231	167	358	294	304	271

INCREASE OVER NO NITROGEN

Raymond—Hinds—Test 2	1929	1930	Average
Nitrate of Soda	333	443	388
Calcium Nitrate	215	412	314
Ammonium Sulphate	167	366	267
Calurea	331	461	396
Leunasalpeter	266	293	280
Cal-Nitro	458	406	432
40% Am. Sul. 60% N. Soda	351	395	348

Poplarville—Pearl River—Test 1	1925	1926	1927	1928	1929	1930	Average 1926-30	Average 1927-29
Nitrate of Soda	380	41	262	-21	597	284	233	430
Ammonium Sulphate	350	94	210	65	411	18	160	311
Leunasalpeter		11	350	64	312	-118	124	331
Calcium Cyanamid	141	3	328	65	344	88	166	336
Calcium Nitrate	334	33	301	30	368	45	155	335
Urea	309	-22	326	135	256	-11	137	291

Poplarville—Pearl River—Test 2						Average	
Fish Scrap	-40	165	100	453	77	151	
Tankage	5	128	69	454	92	150	
½ F. S. & ½ N. Soda	33	223	63	425	70	163	
Calcium Nitrate		212	145	495	41		
½ Tank. & ½ N. Soda	85	176	138	475	101	195	
Dried Blood				627	101		

Purvis—Lamar Average			
Ammonium Sulphate	131	131	131
Leunasalpeter	188	113	151
Calcium Nitrate	124	139	132
Urea	145	120	133
Tankage	80	120	100

Average West Point, Holly Springs, Raymond, and Poplarville—1926-1930

	1926	1927	1928	1929	1930	Average
Nitrate of Soda	256	272	192	373	204	259
Ammonium Sulphate	199	260	245	300	132	227
Leunasalpeter	236	317	194	277	140	233
Calcium Cyanamid	62	293	152	261	207	195
Calcium Nitrate	179	291	222	326	183	240
Urea	176	338	257	275	168	243

An average of four tests, each run five years, has been made for nitrogen sources and is given as the last part of Table 31. This average has the fault of including several soil types, but when the need for many trials is considered, it seems to be justified. It will be seen from this average that nitrate of soda produced the largest increase of any material tested and cyanamid the lowest. The difference in these two extremes was only 64 pounds. The difference between nitrate of soda and ammonium sulphate, which was next to the lowest, was only 32 pounds. This seems to indicate that five of these materials are approximately equally efficient, and slightly superior on an average to cyanamid. Cyanamid has given good results on prairie soils.

TABLE 32—PHOSPHOROUS SOURCES

	INCREASE OVER 300 POUNDS SUPERPHOSPHATE			
	1928	1929	1930	Average
	Longview—Oktibbeha			
300 lbs. Ruhm's		-3	12	4
300 lbs. Basic Slag		96	-35	30
300 lbs. Colloidal		62	36	49
	Starkville—Oktibbeha			
300 lbs. Ruhm's		17	-9	4
300 lbs. Basic Slag		-4	-8	-6
300 lbs. Colloidal		39	15	27
	Poplarville—Pearl River			
300 lbs. Ruhm's	47	248	-37	86
400 lbs. Ruhm's	-3	88	-43	14
600 lbs. Ruhm's	-35	49	-42	-9
	Raymond—Hinds			
300 lbs. Ruhm's		-165	-94	-129

Phosphorus sources have not been tested sufficiently to draw definite

conclusions. Basic slag, Ruhm's Phosphate, and Colloidal Phosphate have been compared with superphosphate and the results, while not consistent, are reported for observation in Table 32.

TABLE 33—POTASH SOURCES

	INCREASE OVER NO POTASH						
	1925	1926	1927	1928	1929	1930	Average
	A. and M. College—Oktibbeha—Test 1						
Trona	167	225	375	423	426	435	342
Sulphate	361	244	462	515	471	548	433
Kainit	388	222	430	876	458	687	427
	Test 2						
Trona		851	457	466	853	896	405
Sulphate		430	551	482	826	881	434
Kainit		454	631	544	548	602	556
Muriate		393	639	461	407	857	451
Nitrate of Soda Potash		413	566	290	849	877	399
	Raymond—Hinds						
Muriate					274	520	897
Kainit					208	550	379
Sul. Pot.-Mag.					834	583	436
Sul. Potash					817	677	497
Manure Salt					269	510	390

The tests reported for potash sources are somewhat inconsistent. With no more evidence than these data give, it seems that one would be justified in purchasing on the basis of price and convenience of handling.

APPENDIX

Plot Technique and Methods

Mixing was done by Experiment Station workers using nitrate of soda, 16 per cent superphosphate, and muriate of potash.

The practice in all the analyses and rates work has been to apply all fertilizer before planting. This was done in a number of ways, conforming in all cases to the practice followed by the individual responsible for growing the crop. In some cases, it was put on an incompleted bed or "list" and covered when the bed was finished; in other cases, a finished bed was opened, the fertilizer applied and covered with a cultivator or harrow. Application by hand was necessary because of constant changes in rate.

Plots were 1-20 acre in size, each having six rows. Border effect was overcome by discarding the two outside rows of each plot, thus reducing the harvested area to 1-30 acre. In order to be sure that the four inside rows of the plot received the right amount of fertilizer, a separate weighing was made for these rows, another weighing being made for the outside rows.

The first plot in the test and every fourth plot thereafter were check plots, which in most of the tests reported were No Fertilizer plots. The various treated plots were arranged in sequence between checks, to give what is commonly called a "series." Wherever possible, a test had four series. Yields per acre were determined from an average of the corresponding plots.

Check yields were calculated for all plots in the test by assuming that there was a gradual increase or decrease in fertility from one check plot to another. A subtraction of the calculated check yield of any plot from the actual yield of that plot gave the increase over the check. In cases where treated checks were used, this increase was converted to increase over no fertilizer. To illustrate this method of calculating increases, an example is given, which is part of the 1930 data from the test on the Central Station farm:

	POUNDS SEED COTTON PER ACRE		
	Actual yield	Calculated check yield	Increase over calculated check yield
No fertilizer—check	621	621	
600 pounds 4-8-8	1192	591	601
600 pounds 4-8-6	1147	561	586
600 pounds 4-8-4	1060	531	529
No fertilizer—check	501	501	

The same general plan was followed in testing sources of materials as described above. In all sources tests, all plots including checks, received a basal application of the plant food elements not being tested. In the case of nitrogen sources, all materials were applied at rates which would supply the same amount of actual nitrogen, which was usually 30 pounds. Materials carrying potash were applied at rates thought to be profitable, all sources supplying the same amount of potash in any one test. Phosphate comparisons were made in various ways, usually between equal quantities of phosphorus carrying materials, regardless of analysis.

Number of Trials

The number of trials or series in each test reported is given below, the test numbers corresponding to the table in which the data are reported:

ANALYSIS TESTS

Test	Trials	Test	Trials	Test	Trials
1	4	13	2	25	3
2	4	14	3	26	3
3	4	15	4	27	3
4	4	16A	4	28	2
		16B	4		
5	3	17	3	29	3
6	3	18	3	30	4
7	3	19A	3		
		19B	2		
8	4	20	3		
9	3	21	3		
10	4	22	3		
11	3	23	3		
12	3	24	3		

Nitrogen Sources

Test	Trials
West Point	3
Starkville	4
Longview	4
Holly Springs	3
Raymond—Test 1	3
Raymond—Test 2	3
Poplarville—Test 1	3
Poplarville—Test 2	3
Purvis	2

Potash Sources

A. & M. College—Test 1	3
A. & M. College—Test 2	4
Raymond	4

Phosphorous Sources

Longview	4
Starkville	3
Poplarville	3
Raymond	7

Actual Cost of Fertilizer

TABLE A—COST OF 600 POUNDS OF FERTILIZER—1925-30

N-P-K	1925	1926	1927	1928	1929	1930
4-8-8	9.27	9.01	9.33	8.51	8.96	8.88
4-8-6	8.65	8.54	8.73	7.98	8.38	8.31
4-8-4	8.02	8.07	8.13	7.46	7.81	7.73
4-8-2	7.40	7.60	7.53	6.93	7.23	7.16
4-8-0	6.77	7.13	6.93	6.41	6.66	6.58
8-8-4	12.14	12.49	12.81	11.62	11.81	11.65
6-8-4	10.08	10.28	10.47	9.54	9.81	9.69
4-6-4	7.36	7.40	7.57	6.90	7.15	7.06
4-4-4	6.70	6.71	7.00	6.33	6.48	6.40
6-6-4				8.98	9.15	9.02
6-4-4				8.41	8.48	8.36
8-0-0				8.32	8.00	7.84
8-4-0				9.44	9.33	9.17
8-0-4				9.37	9.15	8.99

The above costs were calculated from the actual price of nitrate of soda, superphosphate, and muriate of potash.

Prices of Seed Cotton Used

1925	7c	1928	6c
1926	5c	1929	6c
1927	7c	1930	3½c

The above prices of seed cotton were arrived at by using the average price of middling cotton during September, October, and November, assuming that 33 1-3 per cent of the seed cotton is lint.

Analyses of Fertilizer Materials

Materials Carrying Nitrogen

Cottonseed Meal	5-7%	Nitrogen
Calcium Nitrate	15%	Nitrogen
Chilean Nitrate of Soda	15%	Nitrogen
Chilean Nitrate of Soda (Champion Brand)	16%	Nitrogen
Synthetic Nitrate of Soda	16.25%	Nitrogen
Ammonium Sulphate	20.50%	Nitrogen
Cyanamid	22%	Nitrogen
Leunasalpeter	26%	Nitrogen
Calurea	34%	Nitrogen
Urea	46%	Nitrogen

Materials Carrying Phosphorous

Superphosphate	16, 18, and 20% Phosphoric acid

Materials Carrying Potash

Muriate of Potash	48%	Potash
Sulphate of Potash	48%	Potash
Trona	58-62%	Potash
Kainit	12-15%	Potash
Sulphate of Potash-Magnesia	25%	Potash
Manure Salts	20-30%	Potash

Materials Carrying Nitrogen and Phosphorous

Ammophos B	20% Phosphoric acid and 16.44% Nitrogen
Diammonphos	53.4% Phosphoric acid and 21% Nitrogen

Materials Carrying Nitrogen and Potash

Nitrate of Soda-Potash	14-15% Nitrogen and 12-16% Potash
Nitrate of Potash	13% Nitrogen and 44% Potash

Home Mixing

To make a ton of fertilizer use:

	for 4%	for 6%	for 8%
Nitrogen			
	Lbs.	Lbs.	Lbs.
Sulphate of Ammonia	386	578	771
Calcium Nitrate	533	800	1067
Calurea	235	353	470
Cyanamid	364	546	727
Leunasalpeter	308	462	675
Nitrate of Soda (15%)	533	800	1067
Nitrate of Soda (16.25%)	492	739	985
Urea	174	261	348
Phosphoric Acid			
16% Superphosphate	500	750	1000
18% Superphosphate	444	667	889
20% Superphosphate	400	600	800
Potash			
48% Muriate of Potash	167	250	333
48% Sulphate of Potash	167	250	333
60% Trona Potash	133	200	267
12% Kainit	667	1000	1333

To make an 8-8-8 fertilizer from Sulphate of Ammonia, Superphosphate, and Muriate of Potash, as seen from the table, it will take:

771 Pounds Sulphate Ammonia
1000 Pounds 16% Superphosphate
333 Pounds Muriate of Potash

Total ..... 2104 Pounds

The total weight is more than a ton. In most cases, the total weight will not be an exact ton, but the total nitrogen, phosphoric acid, and potash found in the mixture, whatever its weight, will be equal to that found in a ton of the corresponding analysis fertilizer (8-8-8 in the above example.) Fertilizers should usually be bought on a basis of the analysis needed by the crop and the source and cost of nitrogen, phosphoric acid, and potash.

Cautions—Cyanamid should not be mixed with superphosphate unless the mixture is used soon after mixing.

Calcium nitrate and calurea absorb moisture and harden when exposed to the air; they should not be used in home mixing except in small quantities unless the mixture is to be used immediately.

Interest on Investment in 600 lbs. Fertilizer

TABLE B—RETURNS FROM BEST ANALYSES IN TESTS OF THREE OR MORE YEARS' DURATION

Test	Years run	Analysis	Interest on investment in 600 lb. fertilizer with seed cotton at: Av. price received	3c	4c
		Northeast Prairie			
			Per Cent	Per Cent	Per Cent
1—Noxubee	26-28	8-8-4	165	33	77
2—Lowndes	26-28	8-8-4	154	27	69
3—Oktibbeha	28-30	8-4-0	112	11	47
4—Monroe	28-30	8-4-0	102	2	37
6—Oktibbeha	25-30	4-8-8	225	70	127
		Flatwoods			
7—Oktibbeha	26-30	6-8-4	145	26	68
9—Oktibbeha	26-30	6-8-4	145	26	8
		Shortleaf Pine			
12—Choctaw	25-27	8-8-4	282	80	140
13—Choctaw	25-27	8-8-4	481	183	277
14—Webster	26-28	8-8-4	232	65	120
		Brown Loam			
22—Marshall	25-30	4-8-8	352	148	231
23—Marshall	25-29	4-8-8	309	102	169
25—Hinds	25-30	6-8-4	234	67	123
		Longleaf Pine			
27—Pearl River	25-30	4-8-4	258	79	138
29—Pike	26-28	4-4-4	457	177	269
30—Forrest	26-29	8-8-4	143	19	58

Table B shows the profits, expressed as interest on investment, obtained from one good analysis in each test of three or more years duration. The costs of fertilizer used in making the calculations for this table were those actually prevailing during the years of the test. The returns on the investment are given using the prevailing prices of cotton during the years the tests were made and using arbitrary prices of three and four cents per pound for seed cotton. These profits are all based on average increases, which have been reported elsewhere in this bulletin.

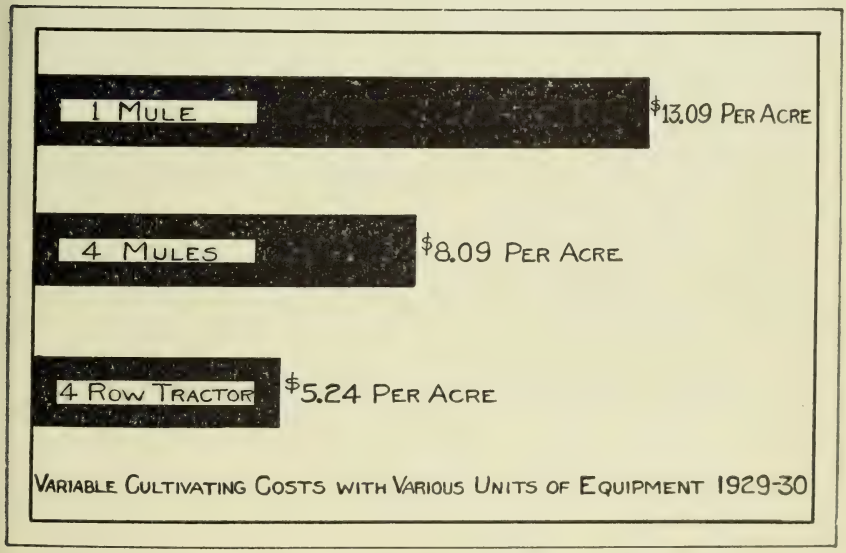
Bulletin No. 290 February, 1931

Making Cotton Cheaper

Can Present Production Costs Be Reduced?

DELTA EXPERIMENT STATION
Stoneville, Mississippi

M. G. Vaiden, J. O. Smith, W. E. Ayres



Graphical illustration of variable per acre cotton production costs—two year averages in the Delta Station tests.

MISSISSIPPI AGRICULTURAL EXPERIMENT STATIONS
A. & M. College, Mississippi
W. R. PERKINS, Director

Summary

Delta cotton production costs have been so high relatively for ten years that profits have been impossible.

The acreage per family on Delta cotton plantations has been so small that sufficient per family production to pay living expenses, overhead, and a fair return on investment, and other operating costs has been very exceptional. Increased mortgaged indebtedness, destitute families, and inability to obtain operating expenses for 1931 are evidences.

Many Delta plantations have been GIVEN, piecemeal, (In the form of advances for food, clothing, automobiles, "Christmas money," etc., etc.) TO TENANTS, in advance, for labor which was never performed. Tenants will continue to ACCEPT so long as planters are willing to GIVE.

No agricultural section can pay an average operating cost of more than $40.00 per acre and an overhead of $20.00 and produce profitable general farm crops. (See table 1, page 9). When production costs exceed $60.00 an acre SOMETHING MUST BE DONE ABOUT IT. Planters can ill afford to wait longer for "something to turn up."

Operating expenses CAN BE MATERIALLY REDUCED. Table 4, page 14; 6, page 15; table 7, page 16; and the graph on page 19 are offered as evidence that IT CAN BE DONE.

Mechanical pickers and strippers will make possible a reduction of 75% in operating labor, reduced housing and other overhead expenses, and profitable cotton production again.

The perfection, production, and use of mechanical pickers and strippers will make possible maximum, economical use of cotton production machinery now available and in the process of development.

Mechanical pickers can and will be made. Present developments are too promising, the need too great, and efforts too extensive for it not to happen.

In order to be ready for machine production when it comes planters generally should accelerate the present evolution in that direction.

MAKING COTTON CHEAPER

Can Present Production Costs Be Reduced?

M. G. Vaiden, J. O. Smith, W. E. Ayres

Yazoo-Mississippi Delta agriculture operates a system admittedly very vicious, but which came to it through necessity rather than choice. For years prior to 1865, the Southern negro had raised cotton under the supervision of the white man. After being freed from slavery, he was unfitted for any other work and was entirely dependent upon cotton raising for a livelihood. Likewise, the planter, having no other labor supply, was forced to depend upon the negro. During the reconstruction period following the Civil War, the planter and the negro found it mutually beneficial to produce cotton on a share basis. Under this system the planter furnished a house and all materials and implements, while the negro supplied the labor. In return for his labor the negro received a certain share of the cotton. However, he was then, and has since been, without resources. It was necessary for the planter to furnish all necessities of life such as food and clothing throughout the year. The planter was to be reimbursed for these advances from the negro's share of the crop.

The tenant system was the only practical solution of this post war problem. Cotton production operations were slow and tedious. One negro family could take care of only 15 acres of cotton. Plowing, planting, cultivating, and harvesting kept the negro busy during much of the year. The 65 years that have passed since 1865 have seen labor saving farm machinery developed for all of the operations except harvesting. Delta planters have accepted much of this. However, they have been forced to retain most of their tenants to insure picking labor. The modern implements used while still op rating under the tenant system have reduced the labor required of each tenant and have provided him with much more leisure; but they have not materially reduced the operating costs for the planter.

Agriculture is the only known industry which has been able to survive and pay its labor in advance. Furnishing supplies of food, clothing, and the like amounts to nothing more nor less than advances for labor. The very nature of the system breeds shiftlessness, indolence, and wastefulness. After men are paid for their labor there is little left as an incentive to do good work or much of it. Delta planters have known for years that the system is wrong, but it is one of those things fastened to this section for such a long

time that it is easier to talk remedies than to remedy the situation. Nothing but cotton planting could have survived so long under such a system. Formerly much profit was derived from sales to tenants, but this is no longer true. The man who evolves an agricultural system adapted to this territory and leaves out the "furnish" or paying labor in advance, will have rendered the entire South a very valuable service.

The Yazoo-Mississippi Delta is probably the only section in the United States which could have supported, for such a long period, a family on every 15 acres. One of the principal Delta counties has grown only 13 acres of cotton per family for the last 10 years. Cotton is recognized as the only cash crop in the county, and statistics for this representative county apply to practically the entire area. No agricultural area can support a family on every 15 acres under present conditions and demands.

Housing tenants is one of the heaviest costs in tenant farming. The average tenant house is worth about $450.00, lasts about 20 years, and occupies, together with the usual garden, etc., about one acre of land, worth at least $50.00. The best drained land is usually selected for cabin sites. Following is an estimate of the usual cost of housing tenants:

6% interest on investment in house	$27.00 per year
6% interest on investment in land	3.00 per year
5% depreciation	22.50 per year
Probable house repairs	26.00 per year
Taxes	3.00 per year
	$81.50

$81.50 distributed over 15 acres amounts to $5.43 per acre of cotton. This expense must be reduced.

Taxes have increased enormously in the last 20 years. There is no hope for relief in this item. Delta people will never be satisfied with poorer school facilities, roads, or other things which taxes maintain. The high percentage of Delta lands out of cultivation has magnified the already too heavy burden on the cotton crop.

Very few Delta plantations have operated at a profit for the past 10 years. Statistics indicate that the mortality of plantation ownership is very high. The natural result of this has been an alarming increase in the mortgaged indebtedness. This is one of the factors which tend to make such depressions as the present one so hard to overcome.

The statement is often made that cotton has ruined the Delta and the South. This is an unjust indictment of the crop because cotton, unquestionably, has stood up under the strain of all expenses as the only cash crop better than any other crop could possibly have done. No agricultural area, however, has ever been permanently prosperous on a one-crop system. Delta production and cotton prices have been sufficient during the last 10 years.

Beck is very lonely and John, whom you cannot see but who follows Beck, is doing a very poor job of land preparation and doing it very slowly.

The cause of the present financial condition of these plantations is not primarily the fact that cotton has been raised exclusively, but that excessive production costs have eliminated the possibility of profits and in most cases have necessitated the use of the capital invested.

The cost of tenant farming has materially increased since the Wor'd War. Higher standards of living, the demand for automobiles, and other luxuries on the part of both landlords and tenants have elevated these costs to such an extent that phenomenal yields or prices must be had to allow the operator a profit.

When 12 "hay burners" are hooked on to an implement something is bound to happen and one man rather than 12 is required.

With three 14-inch bottom plows behind these 12 mules, 50 inches of soil are turned at one trip and the furrow is 9 inches deep instead of 3 inches, as is the case when Beck travels alone.

A heavy duty tractor may replace the 12 mules on the three bottom plow or handle a 6-ft. wheatland plow 5 inches deep thus materially speeding up the soil preparation with only a small percentage of the number of men required with small power units.

One of the fundamental troubles with the tenant system is that the operator takes all of the risk. In good years the tenant gets his half; in bad years he too often gets both halves, as he is unable to sustain his share of the loss. Unpaid tenant accounts in bad years are enormous.

The migration of the negro is a serious problem. Census returns show that the negro population in the South increased less than 2% between 1910 and 1920, while the negro population in other parts of the United States increased nearly 44%. The continuation of this migration from southern agricultural sections to industrial centers is certain. Until recently, manufacturers have been able to rely on foreign labor. New immigration laws, however, prevent them from depending upon this source of labor for the future. A revival of industrial activity will be accompanied by greatly increased demands for labor. The time is approaching when the Delta planter must meet this industrial competition for labor either with higher remuneration or by eliminating the need for so much labor. The former is impossible, the latter highly desirable.

The tenant system of farming, as it has been practiced for the last 65 years, has been outgrown and is not fitted to present conditions. Such an established system, however, cannot be changed overnight. Sane changes must be made.

A few planters have given up the tenant system and are raising their cotton almost entirely by tractor equipment. These few are all fairly close to towns from which they obtain labor for harvesting and chopping. The universal use of such equipment will not be practical, however, until the harvesting problem is solved. It is very probable that satisfactory mechanical pickers will be available within the next few years.

The Delta Experiment Station recognizes a possible solution in mechanical farming. This bulletin contains the results of an investigation comparing tenant and tractor farming. Five tenant-operated and five tractor-operated plantations were selected and accurate cost records kept on their operations throughout 1930. In selecting these plantations, only successful operators were chosen. The ten units are well distributed over the Yazoo-Mississippi Delta.

The records were kept by Mr. M. G. Vaiden, who for nine years was a Delta plantation bookkeeper, and who for the last seven years has been a plantation auditor. Mr. Vaiden was chosen for the work because of his ability to cooperate with plantation owners and bookkeepers in getting definitely the cost of every operation.

The entire cost of plantation operation has been charged to cotton for the reason that it was the only source of revenue. All costs have been reduced to an acre basis. Plantation names have been omitted in accordance with an agreement with the cooperating owners.

Table 1 gives individual and average costs on the 5 tenant-operated plantations. Two of these were operated with quarter hands (1), two with half hands (2), and the fifth with a combination, 45% of the tenants being quarter hands and 55% half hands.

Ginning, and the owner's supervision have not been considered. Eight percent interest on operating capital and 6% on the investment have been charged as direct costs. In computing the amount of the investment, the value of cleared land was assumed to be $50.00 per acre and that of woodland $15.00 per acre. Depreciation was computed on the following basis:

Owners' and Managers' Homes	2½%
All other buildings	5 %
Implements	12½%
Live stock	10 %

(1) A quarter hand on Delta plantations is a tenant who agrees to furnish all of the equipment, material, and labor for raising cotton, while the planter provides a house, the land and one fourth of the cotton seed and fertilizer. The planter received one-fourth of the cotton raised by the tenant.

(2) A half hand is a tenant who agrees to furnish only the labor required to raise the cotton. The planter provides all other necessities and receives one-half of the cotton produced. The tenant pays, also, for one-half of any fertilizer used, as this is not considered a necessity. A majority of Delta tenants are half hands.

TABLE 1—Actual Per Acre Cost of Operation Using Different Tenant Systems In Cotton Production

LINE NO.	ITEMS CHARGED	Part of Crop Retained by Landlord and Plantation Number					Average of Five Plantations
		¼	¼	½	½	¼ ½	
		1	2	3	4	5	
	Tenant Charges						
1	Cash crop advances	$15.89	$19.30	$ 8.80	$ 5.98	$ 7.35	$11.48
2	Moving expense	.30	.05	.08	—	.06	.10
3	Merchandise	6.94	11.62	.32	3.20	3.30	5.07
4	Doctor and drugs	1.70	1.05	.81	.25	.56	.87
5	Feed	7.32	8.09	—	.18	2.53	3.62
6	Land rented to tenants	2.29	.29	—	.77	—	.67
7	Cotton seed	2.81	1.35	—	.16	.33	.95
8	Fertilizers	6.68	3.85	2.37	1.57	1.52	3.20
9	Shop work	.12	.05	—	.04	.02	.05
10	Army worm expense	.96	—	—	.05	.14	.23
11	Extra labor for crops	.27	.68	1.62	3.87	.92	1.47
12	Live stock sales	.34	4.35	—	—	.73	1.08
13	Harvesting help	1.71	2.12	1.87	.33	—	1.21
14	Total tenant charges	47.42	52.90	15.87	16.40	17.46	30.00
	Other Necessary Costs						
15	Ditches, road, fences	.62	1.55	2.17	1.08	2.26	1.54
16	House repairs	.45	.96	.85	1.14	.19	.72
17	Feed & barn expense	2.37	—	5.73	3.84	3.54	3.10
18	Fertilizers	1.43	1.12	2.37	4.10	.97	2.00
19	Cotton seed	.58	—	2.26	1.55	.64	1.01
20	Hay crops	.85	.07	2.03	1.92	—	.97
21	Corn crops	.38	—	—	1.04	—	.28
22	Sundry supplies	.11	—	.37	.30	.33	.22
23	Misc. extra labor	.40	—	.28	.27	.39	.27
24	Total operating expense not chgd. tenant	7.19	3.70	16.06	15.24	8.32	10.11
25	Total operating expense	54.61	56.60	31.93	31.64	25.78	40.11
	Administration						
26	Mgrs., Bkkprs. & Office	4.50	1.57	3.69	5.17	1.92	3.37
27	Insurance	.28	.76	.25	.22	.11	.33
28	Taxes	2.88	3.26	2.85	2.96	2.90	2.97
29	Total administration	7.66	5.59	6.79	8.35	4.93	6.67
30	Total Adm. & Opr. Exp.	62.27	62.19	38.72	39.99	30.71	46.78
31	8% on Adm. & Opr. Exp.	4.98	5.25	3.33	3.46	2.65	3.93
32	Depreciation	3.83	3.47	2.88	3.26	2.45	3.18
33	6% on Invest. Capital	7.78	6.16	6.08	7.50	5.84	6.67
34	Total Production Cost	78.86	77.07	51.01	54.21	41.65	60.56

ALL COSTS BASED ON COTTON ACREAGE

Variation in items of expense is to be expected. The personal factor is variable; soils are not the same; weather conditions vary with localities; community practices are local; and different types and amounts of equipment are used. It is interesting to note, however, that there is less than $2.00 per acre difference in the costs of the two operated with quarter hands, and less than $3.00 per acre difference in the costs of the two operated with half hands. This indicates that the high operating cost is due to the system rather than the individual operators.

Table 2 gives the average costs for the two operated with quarter hands and the average for the two operated with half hands. The cost of the fifth, operated with both types of tenants and the average of all five is repeated on this table to make comparisons more convenient.

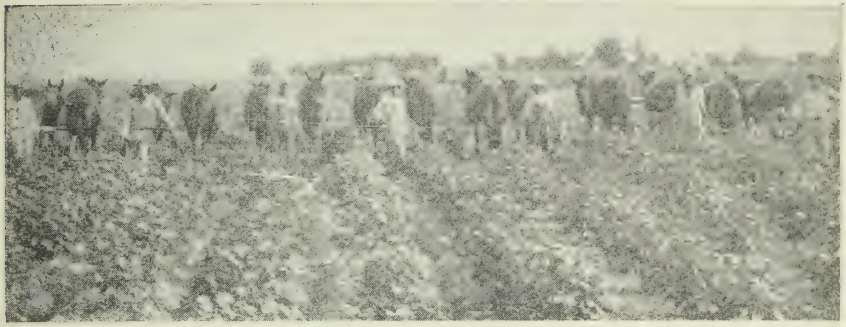
TABLE 2—Average Per Acre Cost of Operation Using Different Tenant Systems In Cotton Production

LINE NO.	ITEMS CHARGED	Part of Crop Retained by Landlord and Plantation Number			Average of Five Plantations
		¼	½	¼—½	
		1 & 2	3 & 4	5 only	
	Tenant Charges				
1	Cash crop advances	$17.64	$ 7.39	$ 7.35	$11.48
2	Moving expense	.18	.04	.06	.10
3	Merchandise	9.28	1.76	3.30	5.07
4	Doctor and drugs	1.38	.53	.56	.87
5	Fees	7.70	.09	2.53	3.62
6	Land rented to tenants	1.29	.39	—	.67
7	Cotton seed	2.13	.08	.33	.95
8	Fertilizers	5.27	1.97	1.52	3.20
9	Shop work	.08	.02	.02	.05
10	Army worm poison	.48	.02	.14	.23
11	Extra labor for crops	.47	2.75	.92	1.47
12	Livestock sales	2.34	—	.73	1.08
13	Harvesting help	1.92	1.10	—	1.21
14	Total tenant charges	50.16	16.13	17.46	30.00
	Other Necessary Costs				
15	Ditches, roads, fences	1.08	1.62	2.26	1.54
16	House repairs	.70	.99	.19	.72
17	Feed and barn expenses	1.19	4.78	3.54	3.10
18	Fertilizers	1.28	3.24	.97	2.00
19	Cotton seed	.29	1.91	.64	1.01
20	Hay crops	.46	1.97	—	.97
21	Corn crops	.19	.52	—	.28
22	Sundry supplies	.05	.34	.33	.22
23	Misc. extra labor	.20	.28	.39	.27
24	Total operating expense not charged to tenants	5.44	15.65	8.32	10.11
25	Total operating expense	55.60	31.78	25.78	40.11
	Administration				
26	Mgrs., bkkprs. and office	3.04	4.42	1.92	3.37
27	Insurance	.52	.24	.11	.33
28	Taxes	3.07	2.91	2.90	2.97
29	Total administration	6.63	7.57	4.93	6.67
30	Total adm. & opr. expense	62.23	39.36	30.71	46.78
31	8% on adm. & opr. expense	5.11	3.39	2.65	3.93
32	Depreciation	3.65	3.07	2.45	3.18
33	6% on invested capital	6.97	6.79	5.84	6.67
34	Total Production Cost	77.96	52.61	41.65	60.56

ALL COSTS BASED ON COTTON ACREAGE

Plantations 1 and 2, operated with quarter hands, produced cotton at an average cost of $77.96 per acre; while 3 and 4, operated with half hands, produced it at an average cost of $52.61. Plantation 5, using both types of tenant, operated at a cost of $41.65 per acre. This plantation was managed solely by the owner who watched personally every detail. He succeeded in keeping tenant advances at a minimum.

Of the total average production cost 50% consists of tenant charges. This 50%, or $30.00 per acre, must be paid from the tenant's share of the crop. In years such as 1930, this is impossible.



Seven 2-mule cultivators do as much cultivating and do it as well as 14 one-mule implements and save 7 men.

14 mules and 4 men with 2-row cultivators cover nearly as much ground as 14 men and 14 mules with one-mule outfits, or 7 men and 14 mules with 2-mule cultivators.

3 men and 3 tractor with 4-row cultivators do still more work, even while the crop is small, than 14 men and 14 mules with one-mule units and more than twice as much after the cotton is large enough to permit running in second gear. This may look revolutionary but it is the simple evolution which has taken place in the Yazoo-Mississippi Delta in the last 10 years.

House repairs averaged only 72 cents per acre. Very little repairing was done in 1930 due to the scarcity of money.

Of the $40.11 per acre average operating cost, $9.62 or 25% is livestock expense. Depreciation and interest on the investment will undoubtedly increase this to around $11.00 per acre.

When only two items, the tenant house, and livestock, are considered their combined cost is over $16.00 per acre. These costs are excessive but are parts of a vicious system which may be profitably changed.

Table 3 shows the cropping systems on the five plantations. An average of 19 acres of cotton is being handled by each family. This indicates that costs on the average plantation with only the usual 15 acres per family are even higher. Over 13% of the land is in feed crops. This 13% supplies only a portion of the necessary feed.

TABLE 3—The Cropping Systems on the 5 Tenant Operated Plantations

Plantation No.	No. of Cabins	Percentage of Total Acreage Used For							
		Cotton	*Corn	Hay	Other Feed	Woods	Ditches Roads	House Sites	Pasture
1	75	65.7	10.1	4.1	3.5	8.1	2.4	4.1	2.0
2	32	79.7	.8	2.5	—	1.7	10.0	5.3	—
3	49	87.3	.2	4.6	3.8	1.0	1.9	1.2	—
4	44	67.5	10.9	2.5	1.5	8.1	2.4	6.0	1.1
5	40	76.2	1.8	2.6	—	7.5	4.4	5.3	2.2
Avg.	48	72.9	6.0	3.4	2.4	6.2	3.5	4.2	1.4

*Corn or corn and beans.

The average cotton acreage on the 5 plantations was 901 acres on which there was an average of 48 cabins, or 19 acres per cabin or family. The average working population was 123, or 7.32 acres per worker. Children of 10 years and up were counted as workers.

As an initial step, however, in lowering production costs for those who continue to use this system, ample feed supplies for plantation work stock and more food for operator and labor will aid materially. As evidence, it is common knowledge that the sections of this state and the South which are producing food and feed are in less trouble due to destitute families now than the one-crop areas. A balanced program lessens the strain of over-extended credits on Delta financial institutions.

The cost of tenant operation can be materially reduced through the use of larger power units. This is being done gradually. In 1920 two-horse cultivators were the exception. They are becoming the rule. There were more tractor cultivators in use in 1930 than two-horse cultivators in 1920. Three and four-horse, two-row, cultivating units are not uncommon sights on Delta plantations now. Through the increase in size of the power units, the number of families can be reduced. This means the reduction not only in advances but also in housing facilities and a very material increase in the acreage of safe lands left open for crop production.

Five tons of sagrain and soybeans per acre on flat buckshot land helps reduce production costs.

This 18-acre oat field on the Delta station in 1915 produced an average of 135 bushels per acre. This is out of the ordinary, but 80 bushel crops handled with machinery are profitable and will enable Delta planters to remove part of the risk from the cotton crop.

Table 4 shows individual and average costs of operation on the five tractor-operated plantations.

Table 5 shows the cropping systems on these five plantations.

Table 6 shows, for the purpose of comparison, the average costs for the tenant system and for the tractor system.

TABLE 4—Actual Per Acre Cost of Operations Using Tractor System In Cotton Production

LINE NO.	Items Charged	Plantation Number					
		6	7	8	9	10	Average
	Operating Costs						
1	Preparing land	$ 1.09	$ 1.59	$ 2.99	$ 2.46	$ 2.46	$ 2.12
2	Planting cotton	.91	.51	1.43	1.15	1.16	1.06
3	Chopping cotton	3.51	1.51	4.23	2.01	2.14	2.68
4	Cultivation	1.19	3.31	2.01	.81	2.04	1.87
5	Applying fertilizers	.57	.23	.81	—	.48	.42
6	Applying army worm poison	.15	1.11	—	—	.36	.32
7	Misc. payroll & exp.	.02	—	—	.07	—	.02
8	Ditches, roads, etc.	.90	.22	.20	1.04	1.00	.67
9	House repairs	.02	.24	—	.20	—	.09
10	Tractor & Imp. repairs	.76	.27	.48	.92	3.29	1.16
11	Feed & hostler	.18	.35	—	—	—	.11
12	Cotton harvesting	4.86	5.77	4.27	2.80	4.77	4.49
13	Fertilizers	4.88	5.06	4.64	—	4.64	3.84
14	Cotton seed	1.28	1.30	.81	1.25	.80	1.09
15	Total operating cost	20.42	21.60	21.87	12.71	23.14	19.94
	Administration						
16	Mgr. Bkkpr. & ofc. exp.	3.19	2.33	4.49	1.82	1.23	2.61
17	Taxes	2.51	2.88	3.72	2.11	4.71	3.19
18	Insurance	.17	—	—	—	.02	.04
19	Total adm. expense	5.87	5.21	8.21	3.93	5.96	5.84
20	Total adm. & opr. exp.	26.29	26.81	30.08	16.64	29.10	25.78
21	8% on adm. & opr. exp.	2.11	2.14	2.41	1.33	2.33	2.07
22	Depreciation	2.40	2.21	1.94	1.51	2.68	2.15
23	6% on invested capital	5.26	5.90	4.12	4.33	8.44	5.61
24	Total production cost	36.06	37.06	38.55	23.81	42.55	35.61

ALL COSTS BASED ON COTTON ACREAGE

The hoeing, or chopping account on tractor plantations is probably the most variable and is accounted for primarily by the difference in seasons and cuts of land as affected by bad grasses. Some plantations hoed twice, others several times. There was considerable variation in the price of labor. Some tractor operators planted cotton in checks and plowed it both ways, thus reducing very greatly hoeing cost.

For the past two years this Station has been keeping detailed cost records on the various farm operations which are not constant for all types of cultivating equipment. Table 7 gives these records. It is interesting to note that the average per acre costs for operations which are variable as given by Table 4 differ by only 22 cents from the Station records for 4-row equipment.

TABLE 5—The Cropping Systems on the 5 Tractor Operated Plantations

Plantation No.	No. of Cabins	Percentage of Total Acreage Used For							
		Cotton	*Corn	Hay	Idle Land	Woods	Ditches Roads	House Sites	Pasture
6	6	77.0	—	—	4.0	16.0	2.0	.9	.1
7	6	94.7	—	—	—	—	3.3	2.0	—
8	5	94.9	—	—	—	—	3.5	1.6	—
9	4	32.6	—	—	—	65.8	1.1	.5	—
10	12	35.2	0.3	5.4	21.6	29.3	7.4	0.8	—
Avg.	6.6	49.5	0.1	2.9	12.1	29.5	5.0	.9	nil.

*Corn or corn and beans.

The average cotton acreage on the 5 plantations was 689 acres on which there was an average of 6.6 cabins, or 104 acres per cabin.

It will be noted that the percentage of land used for cotton is extremely low. This is due to the large amount of woodland and idle land.

TABLE 6—Comparison of Per Acre Cost of Operations of Various Systems Used in Cotton Production

ITEMS CHARGED	Part of Crop Retained by Landlord and Plantation Number			
	¼	½	Average	Tractor System
	1 & 2	3 & 4	1-5	6-10
Tenant charges	50.16	16.13	30.00	
Other operating costs	5.44	15.65	10.11	19.94
Administrative expense	6.63	7.57	6.67	5.84
8% on operating capital	5.11	3.39	3.93	2.07
Depreciation	3.65	3.07	3.18	2.15
6% on invested capital	6.97	6.79	6.67	5.61
Total Production Cost	77.96	52.61	60.56	35.61
ALL COSTS BASED ON COTTON ACREAGE				

The average per acre production cost on the tractor operated plantations was $35.61; $24.95 less than the cost on the tenant operated plantations. The total operating cost, $19.94, was approximately $3.50 per acre more than the usual housing and work stock expense under the tenant system.

The average total tractor production cost, $35.61 per acre, was only $5.61 more than the tenant advances on the 5 tenant-operated plantations. In other words, the tractor operators added $5.61 per acre to the usual tenant advances and thereby owned all of the crop instead of having to share it with a tenant.

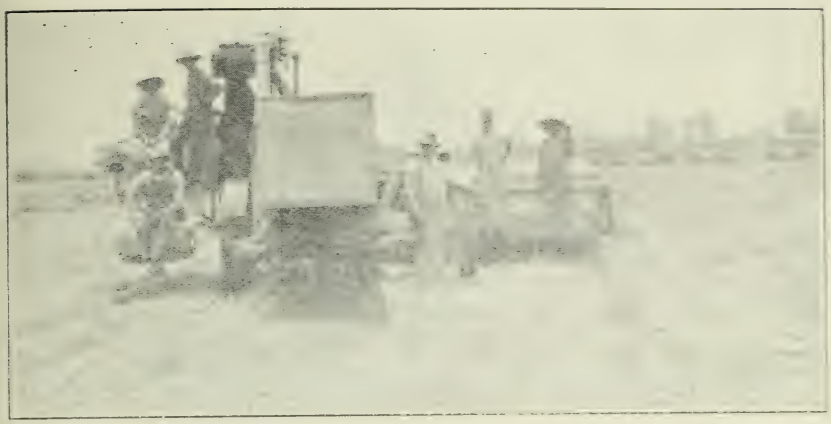
The average plantation size is practically the same for the 5 tenant-operated plantations as for the 5 operated with tractors. An average of 48 cabins was used on the former and only 7 on the latter. The average acreages occupied by these houses were 52 and 13 respectively. This difference is well worth considering, both from the standpoint of housing expense and the acreage released for cropping. A further increase in the acreage available for cash crops is brought about by the reduction in feed crops acreage. This is rather conclusive evidence that the tractor offers at least one possibility of reduced production costs.

TABLE 7—Cultivation Costs With Various Units of Equipment 1929-30 at the Delta Experiment Station, Stoneville, Mississippi

Operations	Dollars Per Acre For Operations With Various Units of Equipment					
	½ Row or 1 Horse	1 Row or 2 Horse(1)	1 Row or 2 Horse(2)	2 Row or 4 Horse	2 Row Tractor	4 Row Tractor
1929						
Breaking, cutting or disking stalks	0.92	0.56	0.56	0.40	0.29	0.29
Preparing seed bed (disking, bedding & harrowing)	3.10	2.40	2.40	1.70	0.66	0.66
Distributing fertilizer	0.60	0.43	0.43	0.43	0.30	0.21
Dragging and planting	0.58	0.40	0.40	0.40	0.33	0.26
7 cultivations	9.00	7.40	6.99	6.04	5.20	3.78
Total for operations having variable cost	14.20	11.19	10.78	8.97	6.78	5.20
1930						
Breaking, cutting or disking stalks	0.88	0.72	0.72	0.62	0.45	0.45
Preparing seed bed (disking, bedding & harrowing)	3.07	2.49	2.49	1.61	0.79	0.79
Distributing fertilizer	0.62	0.54	0.54	0.54	0.62	0.62
Dragging and planting	0.69	0.59	0.59	0.59	0.71	0.71
7 cultivations	6.72	5.17	4.41	3.88	3.87	2.70
Total for operations having variable cost	11.98	9.51	8.75	7.24	6.44	5.27
2 Year Average						
Breaking, cutting, or disking stalks	0.90	0.64	0.64	0.51	0.37	0.37
Preparing seed bed (disking, bedding & harrowing)	3.08	2.45	2.45	1.66	0.73	0.73
Distributing fertilizer	0.61	0.48	0.48	0.48	0.46	0.42
Dragging & planting	0.64	0.50	0.50	0.50	0.52	0.48
7 cultivations	7.86	6.28	5.70	4.96	4.54	3.24
Total for operations having variable cost	13.09	10.35	9.77	8.11	6.62	5.24
Estimated number acres per man	15	24	30	50	65	120

(1) Walking Cultivator (2) Riding Cultivator.

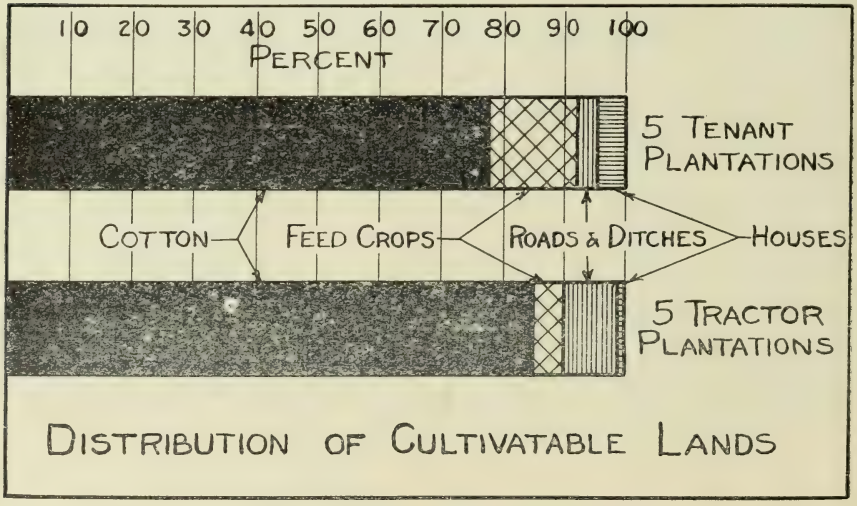
Production costs that were constant (fertilizer, hoeing and picking) for all equipment are not tabulated. The fertilizer was distributed with one, two and four-row planters. Man labor figured at $0.20 per hour; mule, $0.10; tractor and driver at $0.65, when pulling 4-row cultivator, $0.70; depreciation at 10 per cent of sale price.



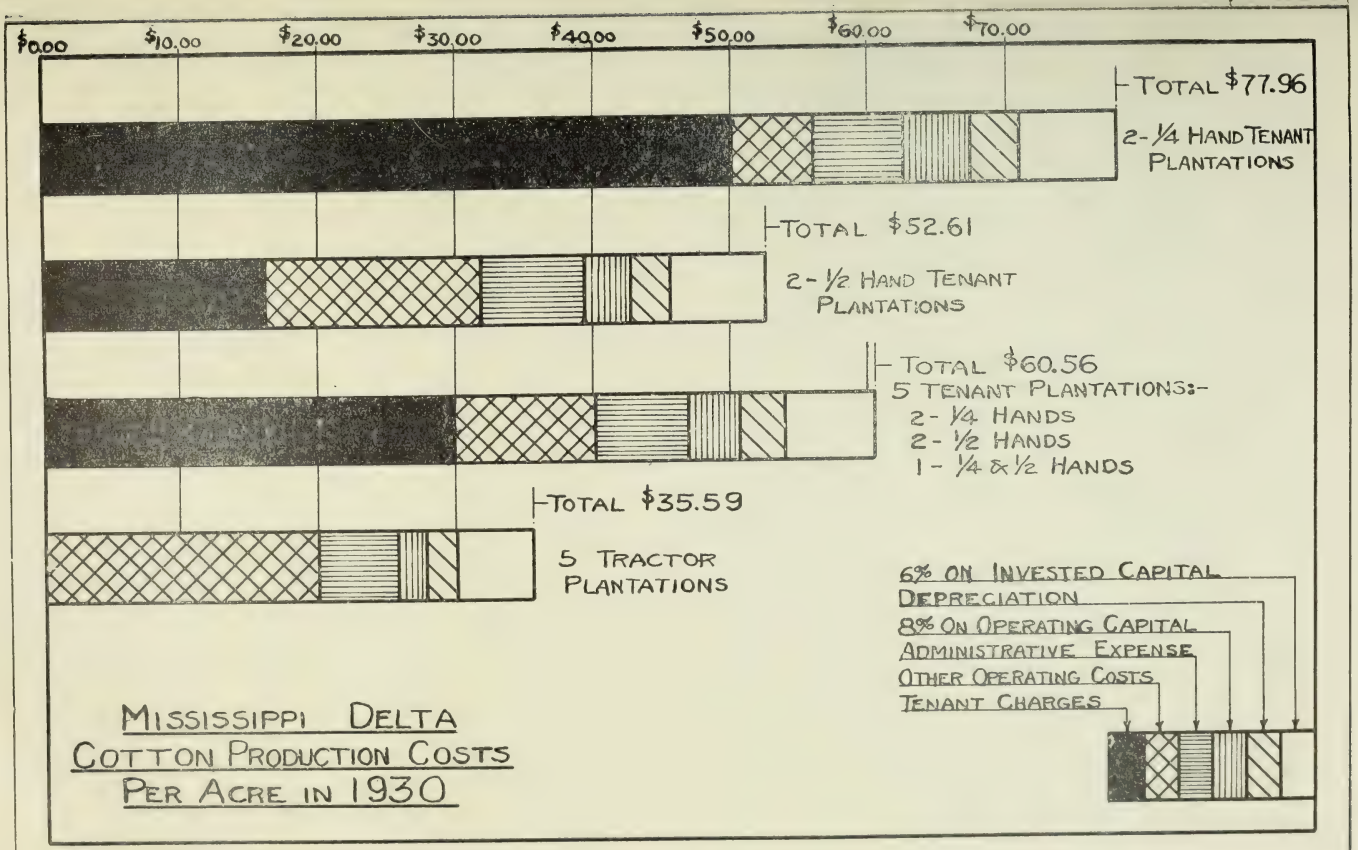
When farm machinery removes the handicap of the tenant system of farming, such crops as this 80-bushel-per acre oat crop may help to redeem Delta agriculture and eliminate the one-crop system.

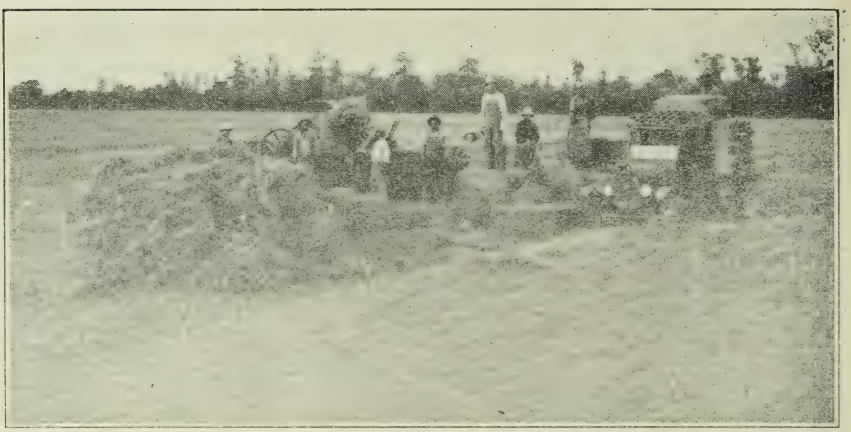
This 49 bushel yield of soybeans handled with combines is not only profitable the year grown but makes possible the production of several profitable cotton crops subsequently.

The tenant system is not conducive to growing such alfalfa crops as this, which are possible on thousands of Delta acres.



Graphical illustration of average land utilization on tractor and tenant farms.


$0.00
$10.00
$20.00
$30.00
$40.00
$50.00
$60.00
$70.00
TOTAL $77.96
2-¼ HAND TENANT PLANTATIONS
TOTAL $52.61
2-½ HAND TENANT PLANTATIONS
TOTAL $60.56
5 TENANT PLANTATIONS:-
2-¼ HANDS
2-½ HANDS
1-¼ & ½ HANDS
TOTAL $35.59
5 TRACTOR PLANTATIONS
6% ON INVESTED CAPITAL
DEPRECIATION
8% ON OPERATING CAPITAL
ADMINISTRATIVE EXPENSE
OTHER OPERATING COSTS
TENANT CHARGES
MISSISSIPPI DELTA
COTTON PRODUCTION COSTS
PER ACRE IN 1930



Carrying plenty of labor throughout the year for cotton harvesting has led to the unprofitable use of too many men in alfalfa hay making in the Delta.

Motor power in the form of tractors is not new, but until about six years ago, tractors were thought of as power for disking, plowing, and land preparation only. They were considered reserve power for taking care of peak loads in the spring and sometimes after oats harvest. Satisfactory cultivating and planting equipment is now available. Unfortunately, the use of cultivating units is still relatively young. The equipment, including the tractors themselves, is not old enough to demand maximum repairs. It is true, however, that this equipment is too new to have been developed to the extent that horse-drawn equipment is developed. Many improvements are to be expected. Tractor operation requires closer supervision than is given the average tenant system. Those giving this supervision should be mechanically inclined. All sorts of operations may be more profitable when more planters become farmers.

Much more labor than is needed for cotton production has been kept on most Delta plantations, primarily for the picking season. Efforts to reduce production labor have been both feeble and futile for the reason that the peak load comes at picking time. Before production costs can be reduced to the minimum the harvest problem must be solved. Human labor may now be largely replaced by machines in almost all agricultural operations except that of picking cotton, but this production machinery cannot be most valuable until picking labor requirements are materially reduced. The universal use of any machine such as the tractor which eliminates labor at certain seasons of the year is not practical unless the labor eliminated is not needed at any other time. Four possible solutions exist.

Truck load of alfalfa. Machinery may make possible, as well as profitable, haying operations such as this on many Delta acres ill adapted to continuous cotton production

First, labor may be imported for the harvest season. It is common knowledge that, before the days of the combine, wheat producers did not attempt to carry, twelve months in the year, sufficient labor for the harvest Southern boys have been "going to the wheat fields" for many years, but since the invention and general use of the combine the wheat fields no longer invite so much labor. Berry and other fruit producers have taken care of their harvest requirements in the same way. However, the wages paid for the harvesting of these crops is sufficiently high to attract labor from distant sections. Cotton planters, except during war times, have never been able to pay such attractive wages. Very little of the imported labor now used in cotton harvesting has migrated of its own accord. Almost all of this labor has been recruited and moved by the cotton planter. Such labor is very often irresponsible and its importation undesirable.

Second, the harvesting capacity of available labor may be approximately doubled by snapping cotton as early as possible and depending upon gin machinery to remove the burrs and trash. Staple cotton producers have never taken kindly to this idea, and staple cotton buyers would protest vigorously.

Third, the use of seed cotton driers preparatory to ginning makes it possible to pick cotton whenever weather conditions permit labor to get into the field, and greatly increases the pickers' capacity. Wet cotton may now be picked and ginned without reducing its value.

Such Delta cotton fields require so much hand labor that profitable production has been the exception rather than the rule for the last 10 years, although both yields and prices have been good.

Fourth, mechanical pickers with which to harvest the principal part of the crop, and strippers with which to finish will practically solve the cotton harvest problem.

When mechanical picking is made possible, hand labor may be reduced to a minimum through the use of labor saving machinery in all production operations. Planters will be able to reduce their labor population at least 75%.

The construction of a satisfactory cotton picking machine was attempted as early as 1850. Since that time millions of dollars have been expended and hundreds of models built. The majority of these attempts met with almost complete failure. The designers of some of these machines have not well understood the problems to be contended with and have not had a clear conception of the essential characteristics of a machine that will be satisfactory to the cotton planter. These essential characteristics are as follows:

1. It must be economical and reasonably priced.

2. It must be as simple as possible. Extremely complicated machines are undesirable. It should be sufficiently simple to permit speedy repair or replacement of parts by good farm mechanics.

This photograph, made during the machinery demonstration at the Delta Experiment Station in March, 1930, shows the interest manifested by Delta planters in improved farm machinery.

3. It must be capable of picking at least as rapidly as the average one-row cultivator travels or from three-quarters to one acre an hour.

4. It should be able to travel over any ground which modern cultivating machinery can negotiate. Cotton fields in general are rather firm during the fall, but depressions exist which remain muddy after cotton is dry enough to pick. The machine should have sufficient traction to travel through these. Picking machines must be able to lower the picking mechanism so as to get the bottom bolls, and at the same time be able to raise all the machinery to get over rough ground and turn around at the end. Power lifts are desirable.

5. It should be able to turn around on roads sufficient for cultivating machinery.

6. It must be adapted to row spacing necessary for maximum yields.

7. It must carry a sufficient load of seed cotton to make discharging cotton in the middle of the field unnecessary when operating on reasonably long rows. It should have means of promptly discharging the cotton at the end of the rows.

8. Machine picking must not involve cleaning the fields of grass, weeds, and vines more thoroughly than is necessary for most profitable production.

It is earnestly hoped that the economical use of farm machinery may, within the next few years, make such plantation homes as this the rule rather than the exception in the Yazoo-Mississippi Delta.

9. The machine must pick in fields where the plant is still green and the staple white without stripping the leaves, breaking the stems, or damaging the green bolls.

10. It must pick either wet or dry cotton. Cotton driers are being successfully used in the treatment of cotton picked while wet. Over 7000 bales were passed through driers in the Delta in 1930.

11. It must pick a high percentage of the open cotton. Planters may have to be satisfied with somewhat incomplete picking. Strippers may be used to good advantage in harvesting, at the end of the season, the cotton left by the pickers.

12. It must drop as little cotton as possible on the ground. Reasonable losses will undoubtedly be more than offset by savings made possible by reduced production expenses.

13. It must not stain or injure the fibers in the picking process, or lower materially the grade of the cotton. Stains from green leaves or from oily parts of the machine are objectionable. The presence of oil adds materially to the fire hazard in storing cotton.

    Fibers should not be torn or cut in picking or delivered in balls, ropes, or other forms which promote the cutting of the fibers in ginning. Machine-picked cotton should be as free from trash as possible. The trash gathered must be removed either by ginning machinery or by the spinners. Hand picking has built up a resistance against trash amongst buyers and spinners. Mechanical cotton pickers may or may not be produced which will pick as clean cotton as human beings, but cleaning machinery at the gin is being improved annually. Texas ginners are able to take stripped cotton, which looks like a pile of trash, and make strict low middling or middling samples. Long staple cotton is much

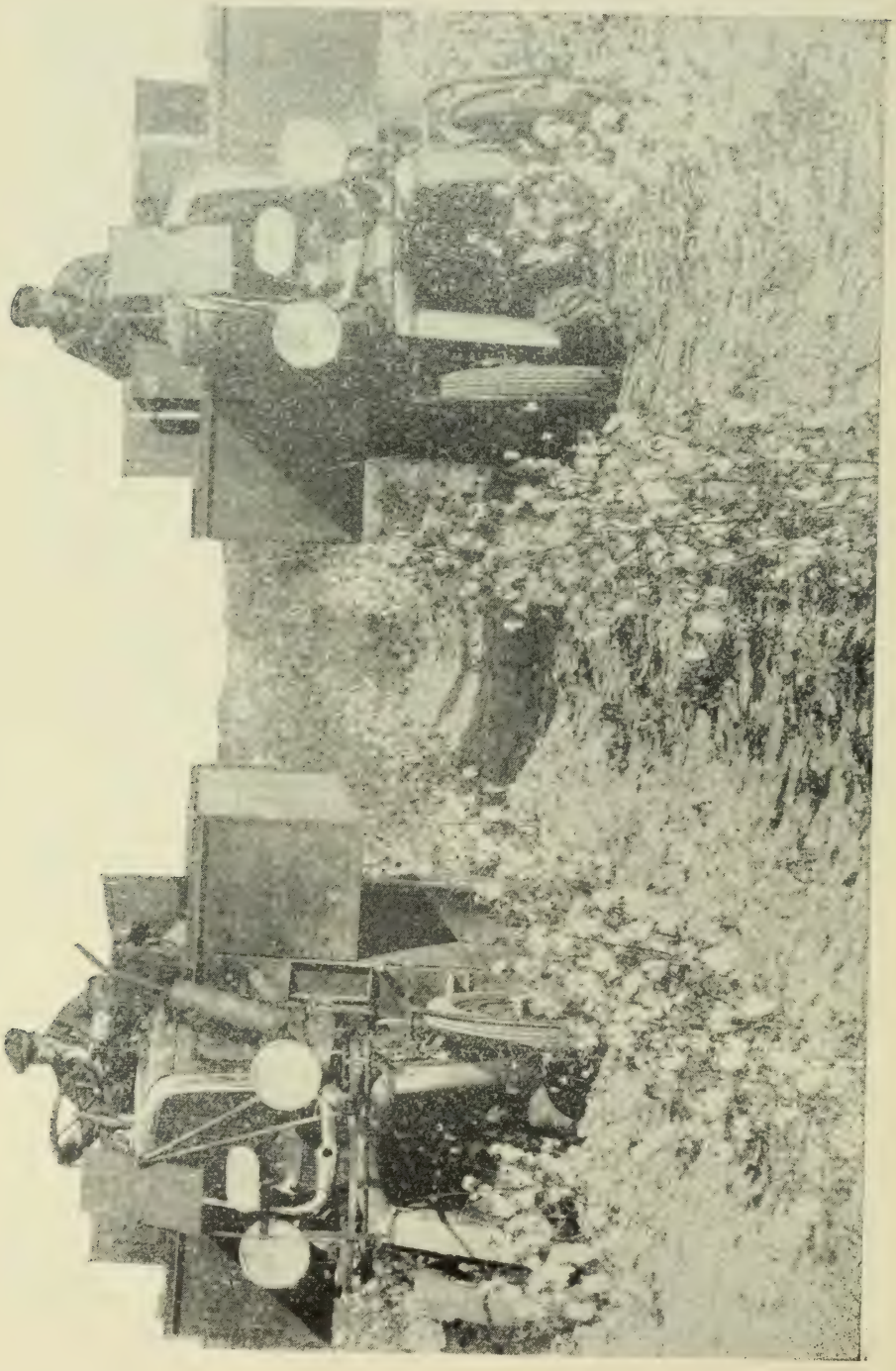
harder to clean, but during 1930 a combination of cleaning and drying equipment used before ginning was found which successfully cleaned mechanically-picked cotton. The drier reduces the moisture content of both the cotton and the trash and reduces their tendency to cling together.

The machine age is here. Agriculture should prepare for it. There seems to be no other way of meeting industrial competition for labor. Fields should be leveled wherever possible by filling pockets from the high places. Perfect drainage is essential to profitable production, regardless of whether machinery is used. Rows should usually run across the low places rather than along them. Very wide and low backbone ditches annually made wider and higher will soon make profitable land of the low places. Turn-row ditches should be so made as to permit any type of machinery used to get out to the end and turn around. Long straight rows are essential to economical cultivation by any method. On rows 100 feet long approximately 25% of the time is used in turning. On rows 1000 feet long this loss is reduced to 3%. If this length can be doubled, the percentage of time used in turning will be further decreased. The turning time is not the only factor. Turn-rows, as heretofore stated, occupy land which needs to be in production for the sake of economy.

Forty-inch rows are approximately close enough for maximum production on any land which will produce cotton waist high in normal years. It requires 11% less labor to cultivate 40-inch rows than 36-inch rows. Very narrow rows should not be used unless the soil is very poor; in that case it is probably more economical to enrich the soil than to close up the rows.

Most Delta fields have a few stumps, old posts, and other obstructions left and are fairly well littered with bricks, roots, and other rubbish. These are all in the way and cause a great deal of breakage and loss of time with ordinary field machinery. They are not at all permissible with present day cotton pickers.

Mechanical cotton picking has made rapid strides in the past two years. This bulletin has been made possible through the cooperaton of G. R. Meyercord and Associates who are developing the Gyracotn Harvester. It was anticipated that this bulletin would contain costs of cotton production, not only for tenant farming and tractor farming, but for completely mechanized farming, including mechanical picking. The designers of this machine have undertaken to produce one particularly suited to regular use on the farm and able to operate under unfavorable conditions, but the difficulties the past season had not been fully anticipated. It has been found impracticable to collect the costs of mechanical picking. In recognition of the cooperation of this organization, it is but a matter of common courtesy to record some of the results shown by this mechanical picker.



The station expects successful commercial production of cotton pickers within the next few years, followed by the use of much less hand labor in both production and harvesting. The above and one other cotton picker are rapidly approaching a degree of perfection which will make their use practical. Several others have made considerable progress.

It operates at any speed up to 5 miles an hour. Under fair conditions on the Delta Station farm it has shown a coverage of an acre an hour. Its operation is not materially impeded by normal growth of vines, weeds, grass, etc. It picks about 75% of the available cotton—as grown in 1930—at a single passage of the machine over the rows, as shown in table 8.

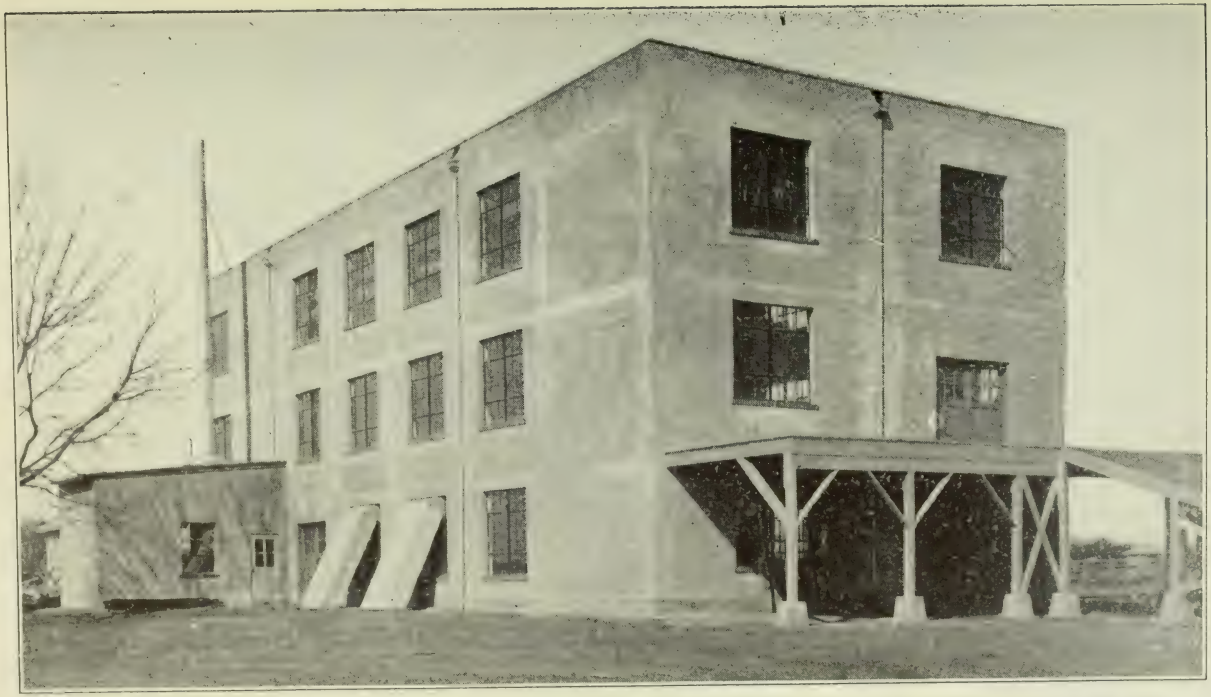
Table 8. Sample Test of Mechanical Picking

	Per Test	Per Acre	Percent
Machine picked cotton, clean ....lb.	49	618	77.3
Left on plants, clean ....lb.	13½	170	21.3
Left on Ground by Machine ....lb.	⅞	11	1.4
Cotton available for picking ....lb.	63⅜	799	100.0
Green leaves, etc. collected ....lb.	7½	94½	
Green bolls collected ....lb.	⅞	11	
Green bolls knocked off ....lb.	⅜	4¾	

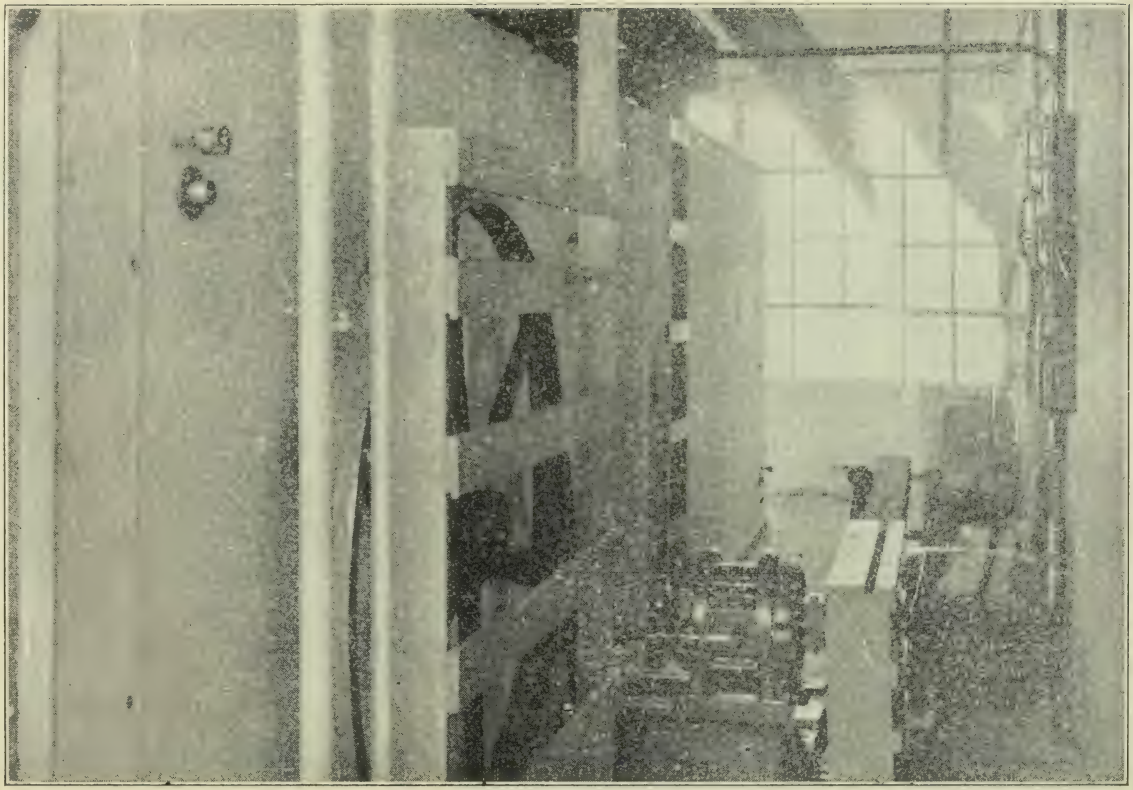
NOTE:—Checked, tractor made cotton, fairly dry, but very heavy green foliage. Machine passed only once over the row.
Date Sept. 22, 1930.

These machines covered 448 acres in different parts of the Delta in 1930. Of this, 152 acres were picked a second time making a total of 600 acres from which 148 running bales were picked. In a normal year the yield from the same acreage would have been more than twice as much. Most gins have not been adequately equipped to handle cotton from mechanical pickers, but one combination of cleaning, drying, and ginning equipment was found which produced middling samples from cotton which had been machine picked from plants either in heavy green leaves or without any leaves.

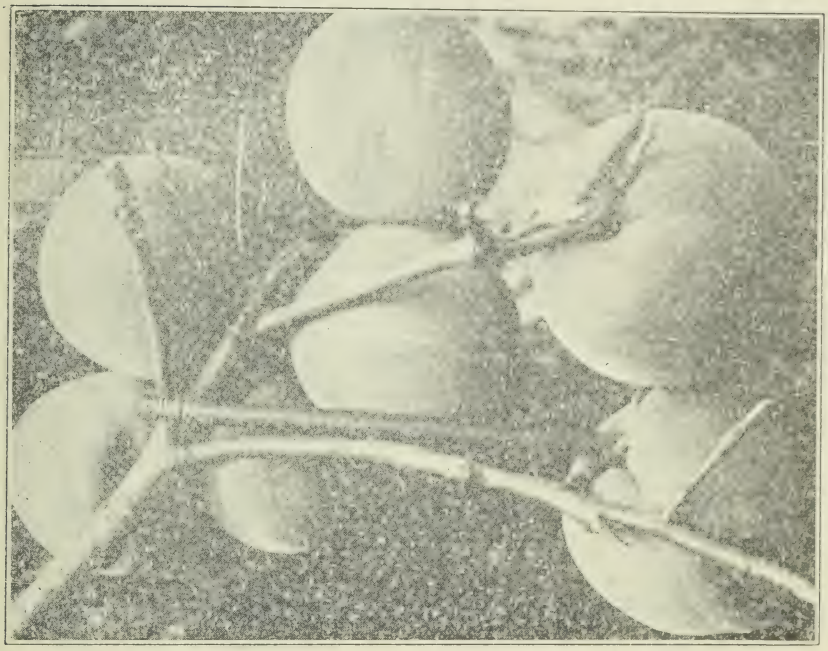
Those interested in the production of cotton at minimum cost should be delighted with this showing of mechanical pickers as indicative of success in the near future. At least five other machines are being developed by other organizations. One of these is very promising. Successful cotton pickers will make possible large reductions in production costs and will revolutionize cotton production methods.



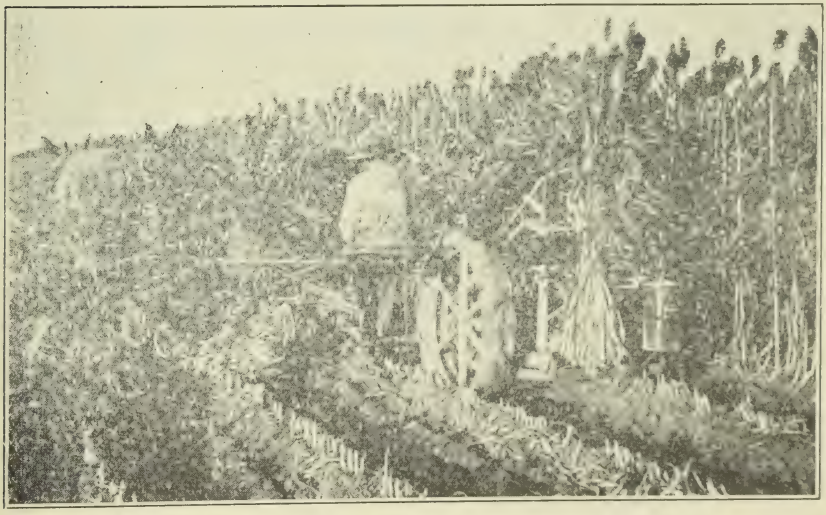
Construction of this Cotton Research Laboratory at the Delta Station has recently been completed by the United States Department of Agriculture. Very valuable information will be collected here from tests on drying, cleaning, ginning and fiber testing of cotton. Results should enable ginners to leave all value in cotton placed there by Mother Nature.



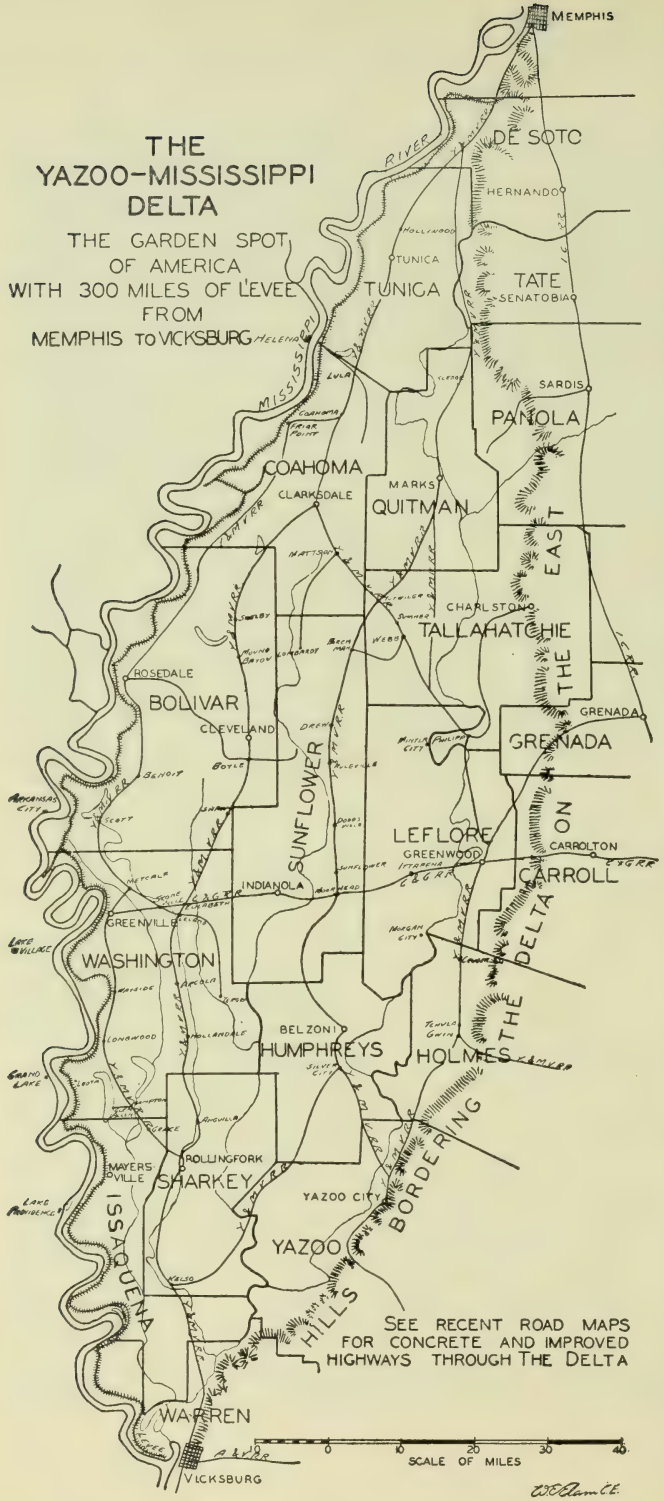
Above is one of the driers being used in experiments in the Cotton Preparation Research Laboratory. Studies are being made of the effects of the moisture content of seed cotton in connection with cleaning and ginning. Gin cut fibers caused primarily by the ginning of damp cotton have been the source of a tremendous loss to the Delta planter. Even extremely wet cotton is properly conditioned for ginning by the extraction of the excess moisture by efficient driers.



DELTA PEACHES — Health — Economical Production



SAGRAIN — Abundant Feed — Low Production Costs



AN ALLUVIAL EMPIRE

Bulletin No. 291 May, 1931

CONSERVATION OF IRON IN VEGETABLES BY METHODS OF PREPARATION AND COOKING

By

Olive Sheets, Ernestine Frazier, and Dorothy Dickins

Fresh vegetables commonly eaten in the South, and of relatively high iron content were cooked by five different methods. Three of these methods were based upon methods of cooking vegetables most frequently used by Southern housewives. The losses of iron were determined by analysis of the fresh vegetable, the cooked vegetable, and the cooking water.

Mississippi Agricultural Experiment Station

A. & M. College, Mississippi

W. R. PERKINS, Director

CONSERVATION OF IRON IN VEGETABLES BY METHODS OF PREPARATION AND COOKING

By

Olive Sheets, Ernestine Frazier, and Dorothy Dickins

INTRODUCTION

Dietary studies made in 1925 and 1927 on 75 rural white families (1) and 80 rural negro families (2) in Mississippi revealed that over 60 per cent of the dietaries were deficient in iron. A similar study (3) made on 200 rural white families in Georgia during the same period showed that 77 per cent of the dietaries were deficient in iron. These studies, therefore, confirm the statement made by Sherman (4) based on estimates of the amounts of iron contained in 150 American dietaries that "the typical American dietary does not contain any such surplus of iron as would justify the practice of leaving the supply of this element entirely to chance." Moreover, the deficiency of iron in the Mississippi and Georgia diets was greater than that in the 150 American dietaries described by Sherman.

Fresh green vegetables were one of the most important sources of iron in these Southern dietaries, but those commonly eaten, namely, turnip greens, mustard greens, collards, and cabbage are, with the exception of cabbage, always cooked. Cabbage is generally cooked. Estimates of their iron content were necessarily based on that of the uncooked vegetable. This means that, unless all the water in which the vegetables were cooked was consumed the deficiency of iron in the Mississippi and Georgia diets would be even greater than the studies indicated.

A survey* was made among rural housewives in Mississippi to determine their favorite methods of preparing and cooking vegetables. The vegetables of relatively high iron content which were most frequently cooked were turnip tops, mustard, collards, butter beans, string beans, cow peas (field peas) and garden peas (English peas). From 112 to 124 records were obtained for each vegetable. In preparing the leafy vegetables for cooking the majority of the housewives discarded the stems and part of the ribs of the leaf since these parts are apt to be tough and unpalatable when cooked.

*Survey made under the direction of Miss Dickins, by Home Economics seniors of Mississippi State College for Women. Unpublished work.

The usual method of cooking was boiling in at least enough water to cover the vegetables. From 64 to 90 per cent of the women interviewed cooked the above vegetables, with the exception of mustard, in this way. 60 per cent cooked mustard in less than enough water to cover it. The time of cooking depended upon the vegetable. 60 per cent of the housewives cooked garden peas and mustard one hour or more; about 80 per cent cooked cow peas, and butter beans 1½ hours or more, and string beans 2 hours or more. Turnip tops and collards were cooked 2 hours or more by 50 and 63 per cent of the women. From 23 to 52 per cent of the women did not use the cooking water in which the above vegetables were cooked. 30 to 37 per cent of the women discarded the water in which butter beans, mustard, and turnip tops were cooked. About 24 per cent did not use the cooking water from garden peas, cow peas, and string beans. 52 per cent discarded the water from collards.

In view of the results obtained by the Mississippi studies, a project was undertaken on losses of iron in the preparation and cooking of vegetables. Its objects were: (1) To determine what losses of iron occurred when vegetables were cooked by the most usual methods; (2) To determine what methods of cooking were best from the standpoint of conservation of iron.

Review of Literature

A number of papers have been published on losses of iron in cooking vegetables but a review of this literature reveals that with the exception of one paper the data given is incomplete. In most instances not more than one or two vegetables have been studied for losses of iron. Moreover, details of the exact methods of cooking are frequently not stated.

Haensel (5) found as high as 70 per cent loss of iron in boiling spinach and lettuce.

Blunt and Otis (6) boiled 5 to 10 grams of spinach, string beans, navy beans, and peas in 25 to 75 cc of distilled water for 20 to 40 minutes (navy beans 2 hours), and determined the losses of iron. The loss varied from 32 to 50 per cent, spinach losing the most iron. Potatoes were peeled, grated, and boiled. They lost between 15 and 22 per cent of their iron. The raw vegetable, the cooked vegetable, and the cooking water were analyzed, but since such small quantities of vegetable were cooked, recoveries were poor.

Courtney, Fales, and Bartlett (7) cooked spinach, New Zealand spinach, and a number of other vegetables by boiling and steaming, and determined the losses in cooking of eight ash

constituents including iron as iron oxide. Unfortunately they used a gravimetric method for iron analysis which was not sufficiently sensitive to determine the losses of iron in most instances. They give data only on spinach. They found that spinach boiled 10 minutes lost 23.4 per cent and spinach boiled 90 miuutes lost 28.2 per cent of its iron as iron oxide. New Zealand spinach boiled 30 minutes lost 50.8 per cent of its iron. Spinach steamed 30 minutes in a double boiler without additional water lost 30.8 per cent of its iron, as iron oxide. The quantity of vegetable cooked and the quantity of water used is not stated.

Field, Peacock, Cox, and Earle (8) determined losses of iron in cooking mustard and turnip greens. They boiled 200 grams of vegetable in 500 cc and 1500 cc of distilled water for 45 minutes. The loss of iron for turnips was 3.3 per cent and for mustard 4.3 per cent when boiled in 500 cc water. When boiled in 1500 cc water the loss of iron was 16 per cent for turnips and 19 per cent for mustard. Turnip greens boiled in tap water lost more than twice as much iron as when boiled in distilled water.

Peterson and Hoppert (9) have conducted the most comprehensive investigations on losses of minerals, including iron, in the cooking of vegetables. The vegetables on which losses of iron were determined were asparagus, string beans, beet greens, cabbage, spinach, celery cabbage, carrots, kolhrabi, onions, parsnips, sweet potatoes, and rutabagas. From 400 to 600 grams of these vegetables were cooked in 4 different ways. Three samples were used for each cooking and the samples combined after cooking and before analyzing. Iron determinations were made on the uncooked and cooked vegetables but the cooking water was not analyzed. The greatest loss of iron occurred in the leafy vegetables in all four methods of cooking with one or two exceptions, celery cabbage losing 67.6 per cent of its iron when boiled. The average loss of iron for all vegetables was as follows: Boiled in enough water to cover, 40.1 per cent; boiled in twice that amount of water, 48.0 per cent; steamed, 21.3 per cent; and pressure cooked 17.4 per cent.

McLaughlin (10) determined the losses of iron in boiling and steaming New Zealand spinach for varying lengths of time. She used different quantities of tap water for the boiled spinach. The steamed spinach was cooked in the top of a double boiler without water except that which clung to the leaves after washing. Steamed spinach cooked 50 minutes lost from 13 to 28 per cent of its iron. Spinach boiled 10 minutes in nearly twice its weight of water lost from 40 to 47 per cent of its iron.

CONSERVATION OF IRON IN VEGETABLES

The work described in this bulletin was undertaken to obtain data on losses of iron when vegetables were cooked by methods most commonly used by Southern housewives, as well as to determine what methods of cooking were most desirable, if iron was to be conserved.

Methods of Preparation and Cooking

Vegetables were obtained in as fresh a condition as possible. They were thoroughly washed, trimmed, and dried at room temperature until the visible moisture had evaporated, but not until they were wilted. String beans were broken into pieces before cooking. The stems of the leafy vegetables (mustard, turnips, and collards) were separated from the leaves, and were not cooked. After the vegetable was prepared for cooking the whole quantity was thoroughly mixed. From 300 to 450 gram samples were then weighed out in duplicate for each method of cooking, and for moisture determinations and analysis of the uncooked vegetable.

All cooking was done on an electric stove. Vegetables were boiled in covered three-cornered aluminum vessels of the same size and shape. Duplicates were cooked on one hot plate at the same time, and were turned around during the cooking to insure a more uniform temperature. The vegetables were put on in boiling water and the time counted from the time they were first placed in the water.

The steamer and pressure cooker were also aluminum. Duplicates were cooked on the same hot plate at as nearly the same temperature as possible.

Five different methods of cooking were used; three methods of boiling and two methods of steaming. The former were based upon those commonly used by Mississippi housewives in boiling vegetables. The time of cooking and the quantity of water used varied with the vegetable as well as with the method of cooking. The methods were as follows:

1. Boiling in 400 to 1000 cc of water 1 to 2½ hours.
2. Boiling in 400 to 1000 cc of water ½ to 1¼ hours.
3. Boiling in 200 to 500 cc of water ½ to 1½ hours.
4. Steaming ½ to 1½ hours.
5. Cooking in a pressure cooker 8 to 15 minutes.

The larger amount of water was somewhat more than enough to cover the vegetable. The smaller amount of water was from ½ to ¼ enough water to cover the vegetable. The longer period of time was the longest time ordinarily used in

cooking that vegetable. The shorter period of time was the time required to cook the vegetable tender. After cooking, the vegetable was drained from 3 to 5 minutes, or until the water drained off a drop at a time.

Only distilled water was used in cooking, since tap water always contains some iron, and its reaction and mineral constituents effect the losses of iron as well as other nutrients of the vegetables cooked in it. Moreover, the composition of tap water shows wide variations in different localities. In order to determine the effect of the composition of the tap water on losses of nutrients in cooking, a thorough and prolonged study would be required which could not be undertaken as a part of this project. It was necessary in a study of this kind to eliminate as far as possible conditions which would lead to variations in results.

ANALYSIS OF VEGETABLES

Preparation of Samples and Materials Analyzed

Since it is customary to discard the stems and a portion of the ribs of the leaves of collards, mustard, and turnip tops before cooking these vegetables, the leafy portion of one or two samples of each vegetable was separated from the stems and ribs of the leaves and each part analyzed separately for iron. The roots of a number of samples of turnips were also analyzed separately from the leaves.

All samples of vegetables were dried at 100° C. in an electric oven, finely ground, and thoroughly mixed before analyzing for iron. Moisture determinations were made on the fresh uncooked vegetable, and on the dried ground samples before analysis. Four samples were usually taken both for moisture and analysis. The cooked vegetables were spread out on large watch glasses to dry.

Each cooking of vegetable was analyzed separately. The water from each cooking and the rinsings were poured into a Kjeldahl flask and evaporated to dryness. The residue was then wet ashed and analyzed.

Method of Analysis

The method of analysis was based upon that of Kennedy for the determination of iron in blood and tissue (11). The modified Kennedy Method was as follows: The weighed sample, usually two or three grams, was placed in a 300 cc Kjeldahl flask and from 5 to 12 cc of concentrated sulphuric acid added. An excess of acid was avoided but the flask was not allowed to

become entirely dry during digestion. The water from some of the cookings required much more than 12 cc of acid, small additions being made during the digestion. From 1½ to 3 cc of acid were left in the flask when digestion was complete. A 3 gram sample usually required about 12 cc of acid. Digestion was carried out over Argand burners, the flame being turned low until frothing ceased and the heat then increased until the acid began to wash down the sides of the flask. It was then cooled and from 1 to 5 cc of 60 per cent perchloric acid added. Heating was continued until the contents of the flask were clear and almost colorless. The flask was cooled, one drop of conc. nitric acid added and about 50 cc of distilled water. The flask was heated over the water bath for about an hour to insure complete solution of the iron. It was then cooled and the contents transferred to a 100 cc volumetric flask. This was made up to volume and the contents thoroughly mixed at about 20° C. 1 cc was pipetted out and titrated with standard alkali. N-4 being a convenient strength. 5 or 10 cc of the solution, depending upon the quantity of iron present, was measured into a 50 cc glass-stoppered cylinder and sufficient dilute sulphuric acid of known strength (1 part conc. acid to 9 parts distilled water) was added to make the acidity equivalent to 80 cc of N-4 alkali (0.78 grams sulphuric acid).

The volume was made up to 15 cc with distilled water, 10 cc of iso amyl alcohol and 5 cc of a 20 per cent solution of potassium thiocyanate added. The mixture was shaken thoroughly, and the colored layer of alcohol allowed to separate. It was then pipetted off into a test tube. The colored layers of alcohol from the standard and unknown were poured into the colorimeter cups and compared in the colorimeter.

Preparation of Standard—Analytical iron wire was used as a standard. It was first analyzed to determine its purity by passing a solution through the Jones reductor and titrating with a standard permanganate solution. Iron wire equivalent to 0.2 grams of pure iron was weighed out and dissolved in 40 cc of 10 per cent sulphuric acid. 1.5 cc of conc. nitric acid was added and the whole made up to 1000 cc. 25 cc of this stock solution was diluted to 200 cc and used for a standard. 1 cc, 1.5 cc, and 2 cc of this solution containing .025, .0375, and .05 mgs. of iron respectively were used as standards. The required amount of standard, as determined by a preliminary test on the unknown, was measured into a 50 cc cylinder, made up to the same volume and acidity as the unknown, and treated in the same way.

Precautions—It was found necessary to keep the volume

and acidity approximately the same in all determinations in order to obtain comparable results, since both affect the formation of the ferric thiocyanate. It was also necessary to cool the solution during warm weather to 20° C or below and to carry out the last part of the analysis as quickly as possible since increased temperature leads to more rapid reduction of the iron to the ferrous state.

Great care was taken throughout the process of preparing, drying, and analyzing the vegetables to avoid iron contamination. Only the purest reagents were used in analysis. They were tested for their iron content. It was found that the C. P. acids contained so little iron that with the quantities used their iron content could not be determined. The purest samples of potassium thiocyanate obtainable contained a small amount of iron, but this did not lead to error since the same quantity was added both to the unknown and the standard.

Results

The iron content of the leafy portion of mustard, turnips, and collards as compared with that of the stalks and ribs of the leaf, and also the iron content of the leaves of turnips as compared with the roots are given in Table 1. The results show that compared on the dry basis the leafy portion contains from 3 to 5 times as much iron as the stems and ribs of the leaves, and that the leaves of turnips contain more than five times as much iron as the roots. The leaves of mustard including the ribs were also analyzed separately from the stems of the leaf. The stems contained about half as much iron as the leaf. The results on the stems and leaves of mustard are in accordance with those reported by Holliday and Noble* on spinach.

The methods of cooking the seven vegetables and the losses of iron resulting from the different methods of cooking appear in Table 2. A comparison of these losses expressed as per cent is given in Table 3. The greatest loss of iron occurred in all seven vegetables when they were boiled the longest period of time in the largest quantity of water. Collards, string beans, and field peas lost from 25 to 29 per cent of their iron when cooked in this way. The loss varied in different vegetables from 9 to 29 per cent, mustard losing the least iron. The average loss of iron for the seven vegetables was 20.5 per cent. In every instance the vegetables lost less iron when boiled in the same quantity of water as that used in method 1, but a shorter time: though with five of the vegetables the difference was not more than 4 per cent. The average loss of iron for the

*Holliday and Noble, Hows and Whys of Cooking, page 6. Work done by Margaret Abt.

second method of cooking was 16.6 per cent. The difference between the losses of iron when vegetables were boiled in a small quantity of water the shortest time and the losses by the first two methods of boiling was more striking. The average loss was 9.8 per cent or less than half that which resulted when vegetables were boiled by the first method. The smallest losses of iron occurred when the vegetables were steamed or when they were cooked in the pressure cooker. With one exception all the vegetables lost less iron when steamed than when boiled in any of the three ways. Only five vegetables were cooked in the pressure cooker, but all of them lost less iron than when boiled. The average loss of iron for steaming was 6.9 per cent or one-third of that lost when the vegetables were boiled by the first method. The average loss of iron for cooking in the pressure cooker was 5 per cent or one-fourth that lost when boiled by the first method. Two of the five vegetables cooked in the pressure cooker lost decidedly less iron, and three of them slightly more iron than when steamed.

Discussion

The practice of discarding the stalks and ribs of the leaves of turnips, mustard, and collards, before they are cooked would seem justifiable from the standpoint of palatability and increased iron content of the cooked product. The decrease in the time required for cooking would also be a decided advantage.

In general the results obtained on the losses of iron in cooking vegetables are in accord with those reported by other investigators. Both the quantity of water used and the length of time the vegetable is cooked are important factors in the losses of iron as well as other nutrients. In boiling vegetables, Peterson and Hoppert found that doubling the quantity of water used increased the losses of iron 20 per cent. Holliday and Noble (12) show the effect of time on losses of nutrients in boiled vegetables. Results obtained in their laboratory* were compared with those reported by Peterson and Hoppert. The former boiled cabbage and cauliflower eight and nine minutes respectively, while the latter boiled them thirty minutes. These vegetables when they were boiled eight minutes lost from one-third to two-thirds as much dry matter, and one-fifth to two-fifths as much protein as when they were boiled thirty minutes. This occurred in spite of the fact that the Chicago investigators used more water in cooking the same quantity of vegetable.

Our results as well as those of Peterson and Hoppert indicate that the smallest losses of iron take place when vegetables

*Experiments done by Fannie Jackson.

are steamed by either of the two methods. However, the losses of nutrients by steaming may be greatly increased under certain conditions. Denton (13) found that "if conditions within the steamer are such that water washes down over the vegetable mass steaming may cause very large losses. Particularly is this true with pressure steamers." The losses to which she referred applied to all soluble nutrients including total ash.

Holliday and Noble found that if carrots were "surrounded by water" when cooked in a pressure cooker the losses in soluble carbohydrates was considerably greater than as if they were boiled in an open kettle. It is to be expected that losses of iron and other soluble nutrients would be large when vegetables are surrounded by water and cooked in a pressure cooker, since at a high temperature disintegration of the vegetable occurs to a greater extent. It would seem that if nutrients are to be conserved in steaming by either method it is necessary that the vegetable come in contact with as little water as possible during the cooking process.

Although the results obtained by various investigators on the comparative losses of iron by different methods of cooking agree in a general way, there are wide variations in the percentages of loss reported for any one method of cooking or any one vegetable. The losses reported by us are considerably less than those reported by the Wisconsin investigators for the same general methods of cooking. A number of factors are doubtless responsible for this lack of agreement. The composition of the sample of vegetable cooked, the state in which it is cooked i. e. whether it is left whole or cut into pieces, the composition and reaction of the water used in cooking, the temperature at which the vegetable was cooked, the kind of cooking utensils used. are all factors which would affect the results.

Summary

The leafy portion of mustard, turnip, and collard leaves was separated from the stems and ribs, and each analyzed separately for iron. The leafy portion contained from three to five times as much iron as the stems and ribs compared on the dry basis. The leaves (including the ribs) and the stems of mustard were analyzed for iron. The stems contained about one-half as much iron as the leaves. The roots and leaves of six samples of turnips were also analyzed separately for iron. The leaves contained five times as much iron as the roots.

Seven fresh vegetables, namely, mustard, turnip greens, collards, cow peas, garden peas, butter beans, and string beans were cooked by four or five different methods to determine

losses of iron. The methods of cooking used were (1) boiling in more than enough water to cover the vegetables from 1 to 2½ hours; (2) boiling in the same quantity of water as method 1, ½ to 1¼ hours; (3) boiling in ½ to ¼ enough water to cover the vegetable ½ to 1¼ hours; (4) steaming, and (5) cooking in the pressure cooker.

The greatest loss of iron resulted in every instance when the vegetable was boiled by the first method. The average loss for the seven vegetables was 20.5 per cent. Boiling by the second method led to a smaller loss of iron in every instance, the average loss being 16.6 per cent. A much smaller loss of iron occurred in every vegetable except one, when they were boiled by the third method, the average loss being 9.8 per cent. The smallest losses of iron occurred when the vegetables were steamed or were cooked in the pressure cooker. The average loss of iron for the seven vegetables cooked in the steamer was 6.9 per cent, and for the five vegetables cooked in the pressure cooker was 5.0 per cent.

PRACTICAL APPLICATIONS

There would seem to be no doubt that, if we are to conserve iron as well as other nutrients in cooking vegetables, the best methods are boiling or steaming in a small quantity of water the shortest period of time required to get them tender. Unfortunately, we cannot cook all vegetables by these methods and produce a palatable sightly product. Steaming in a pressure cooker causes destruction of the color of green vegetables. If the strong flavored vegetables as onions, cabbage, and collards, are cooked in this way or boiled in a small quantity of water, they develop an undesirable flavor and odor. Therefore, the method generally recommended for such vegetables, namely, boiling in a large quantity of water in an uncovered vessel is preferable. It is neither desirable nor practical to cook delicately flavored vegetables such as fresh English peas and butter beans which require cooking only a short period of time, in a pressure cooker. The high temperature destroys their flavor and is apt to produce a mushy product. They should be steamed in a steamer or boiled in a small quantity of water. This applies also to very tender green vegetables such as spinach. Mustard and turnip greens (not the roots) may be cooked to advantage in a pressure cooker provided they come in contact with very little water, and one does not object to their loss of color. Both the flavor and appearance of the turnip roots are objectionable if cooked in a pressure cooker.

All vegetables whether they are steamed or boiled should

be cooked a minimum time if their nutrients, especially iron which is readily lost, are to be conserved, as well as their flavor and color preserved.

This is not in accord with methods of cooking commonly in use by many housewives. Unfortunately most of us prefer our food prepared as we have been accustomed to eating it, and we are not apt to be open to conviction as to new and foreign ways of cooking. Seasoning, however, is a most important factor in producing the flavor which we may prefer. In so far as this applies to the Southern housewife more desirable methods of cooking may perhaps be introduced, and found acceptable, if cabbage, collards, turnip greens, mustard, string beans, and field peas are seasoned in the customary Southern fashion with salt pork or bacon.

Applying then, the results of our investigations as well as those of other workers in the cooking of vegetables, to general methods of cooking, we would make the following recommendations:

1. Cook **all** vegetables only long enough to produce a tender product.

2. Steam in a steamer or boil in a small quantity of water (¼ to ½ enough water to cover them) all young tender delicately flavored vegetables which require a short period of time to cook. Such vegetables would include: garden peas, butter beans, spinach, young tender string beans, and roots of vegetables, as young carrots and turnip roots.

3. Boil in more than enough water to cover them, all strongly flavored vegetables such as cabbage, onions, collards, and kale.

4. Boil in just enough water to cover them, or less; or steam in a pressure cooker those vegetables which require longer cooking such as mustard, turnip greens, field peas, mature carrots, beets, and turnip roots. The latter, as well as any other vegetable the flavor of which is injured by high temperature should be boiled.

Table I— Comparison of the Iron Content of the Leafy Portion, the Stalks, and Ribs of the Leaves of Turnips, Mustard, and Collards, and a Comparison of the Iron Content of Turnip Roots and Leaves.

Vegetable	Part of Vegetable Analyzed	No. Samples	Moisture Per Cent average	Iron Per Cent average	Gms. Iron Per 1 Gm. Dry Veg. average
Turnips	Leafy Portion*	2	86.66	.004464	.000331
	Stems & Ribs of Leaf	2	92.59	.000891	.000116
	Whole Leaves**	6	89.51	.004144	.000392
	Roots	6	92.76	.000521	.000072
Mustard	Leafy Portion	1	90.66	.003545	.000379
	Stems & Ribs of Leaf	1	95.32	.000447	.000095
	Whole Leaves	5	91.56	.003571	.000423
	Stems of Leaf	5	93.70	.001583	.000251
Collards	Leafy Portion	2	84.09	.001766	.000111
	Stems & Ribs of Leaf	2	88.46	.000300	.000026

*The leafy portion of each vegetable was carefully separated from the stalk and from all but the smaller ribs of the leaf.

**The whole leaves of turnips and mustard including the ribs were analyzed.

Table II—Losses of Iron by Different Methods of Cooking

Vegetable	Meth. of Cooking	Quantity Vegetable Cooked	Moisture Uncooked Vegetable	Gms. Fe. In Uncooked Veg.	Gms. Fe. in Cooked Vegetable	Gms. Fe. in Cooking Water	Tot. No. Gms. Fe. in water & Vegetable Cooked	Av. Error
		gms.	per cent					Per cent
	1 Boiled in 600 cc water 2 hrs. 30 min.	400	*90.17	.008646	1. .007043 2. .007132 Av. .007087	1. .000811 2. .000961 Av. .000886	1. .007854 2. .008093 Av. .007972	−7.8
Turnip Tops	2 Boiled in 600 cc water 1 hr. 15 min.	400	*89.90	.009016	1. .007516 2. .007613 Av. .007565	1. .000882 2. .000789 Av. .000835	1. .008398 2. .008404 Av. .008401	−6.8
	3. Boiled in 250 cc water 1 hr. 15 min.	400	89.90	.009016	1. .008444 2. .008265 Av. .008354	1. .000361 2. .000446 Av. .000403	1. .008805 2. .008711 Av. .008758	−2.9
	4. Steamed using 600 cc water 1 hr. 20 min.	400	90.17	.008615	1. .007897 2. .008063 Av. .007980	1. .000441 2. .000459 Av. .000450	1. .008338 2. .008522 Av. .008430	−2.5
	5. Pressure cooker in 50 cc water 15 min. at 15 lbs. pressure	400	90.17	.008646	.008220	.000245	.008465	−2.1
	1. Boiled in 600 cc water 2 hrs. 30 min.	400	91.03	.012999	1. .011193 2. .011637 Av. .011784	1. .000887 2. .000881 Av. .000884	1. .012818 2. .012519 Av. .012668	−2.3
	2. Boiled in 600 cc water 1 hr. 5 min.	400			1. .011821 2. .011893 Av. .011857	1. .000817 2. .000822 Av. .000819	1. .012638 2. .012715 Av. .012676	−2.5
Mustard	3 Boiled in 200 cc water 1 hr. 5 min.	400			1. .011867 2. .012322 Av. .012094	1. .000399 2. .000281 Av. .000341	1. .012266 2. .012603 Av. .012433	−4.3
	4. Steamed using 500 cc water 1 hr. 5 min.	400			1. .012119 2. .012125 Av. .012122	1. .000341 2. .000327 Av. .000334	1. .012460 2. .012452 Av. .012456	−4.5
	5. Cooked in pressure cooker in 25 cc water at 15 lbs. pressure for 15 min.	400			.012845	.000253	.013098	+0.7
Collards	1. Boiled in 1000 cc water 2 hrs. 15 min.	350	89.53	.006841	1. .004853 2. .004832 Av. .004842	1. .001531 2. .001525 Av. .001528	1. .006384 2. .006357 Av. .006370	−6.9
	2. Boiled in 1000 cc water 1 hr.	350			1. .004777 2. .005314 Av. .005045	1. .001321 2. .001357 Av. .001339	1. .006098 2. .006671 Av. .006384	−6.7
	3. Boiled in 500 cc water 1 hr.	350			1. .005554 2. .005808 Av. .005681	1. .001060 2. .001056 Av. .001058	1. .006614 2. .006864 Av. .006739	−1.5
	4. Steamed using 500 cc water, 1 hr. 5 min.	350			1. .006134 2. .006114 Av. .006124	1. .000443 2. .000555 Av. .000501	1. .006583 2. .006668 Av. .006625	−3.2
	1. Boiled in 400 cc water 1 hr. 30 min.	300	66.15	.007031	1. .005255 2. .005316 Av. .005285	1. .001345 2. .001402 Av. .001373	1. .006600 2. .006718 Av. .006609	−4.7
Field Peas	2. Boiled in 400 cc water 1 hr.	300			1. .005610 2. .005415 Av. .005512	1. .001255 2. .001210 Av. .001232	1. .006865 2. .006647 Av. .006756	−3.9
	3. Boiled in 200 cc water 1 hr.	300			1. .006044 2. .006478 Av. .006261	1. .000605 2. .000555 Av. .000580	1. .006649 2. .007033 Av. .006841	−2.7
	4. Steamed 1 hr.	300			1. .006637 2. .006388 Av. .006512	1. .000318 2. .000482 Av. .000375	1. .006955 2. .006810 Av. .006887	−2.1

Table II (Continued) Losses of Iron by Different Methods of Cooking

Vegetable	Meth. of Cooking	Quantity Vegetable Cooked gms.	Moisture Uncooked Vegetable per cent	Gms. Fe. In Uncooked Veg.	Gms. Fe. in Cooked Vegetable	Gms. Fe. in Cooking Water	Tot. No. Gms. Fe. in water & Vegetable Cooked	Av. Error %
English Peas	1. Boiled in 400 cc water 1 hr.	350	*78.48	.005844	1. .004688 2. .005466 Av. .005081	1. .001676 2. .001071 Av. .001373	1. .006364 2. .006537 Av. .006450	+10
	2. Boiled in 400 cc water 30 min.	350			1. .005256 2. .005164 Av. .005210	1. .000493 2. .000625 Av. .000559	1. .005749 2. .005789 Av. .005769	−1
	3. Boiled in 200 cc water 30 min.	350			1. .005078 2. .005674 Av. .005376	1. .000706 2. water lost	1. .005784	−1.
	4. Steamed 40 min.	350			1. .005750 2. .005351 Av. .005550	1. .000127 2. .000146 Av. .000136	1. .005877 2. .005497 Av. .005687	−2.
	5. Cooked in pressure cooker without water 8 min. 10 lb. pressure	350	*74.44	.006507	.006033	.000268	.006301	−3.
Butter Beans	1. Boiled in 500 cc water 1 hr. 30 min.	375	*64.99	.011093	1. .009034 2. .008896 Av. .008965	1. .002597 water lost	1. .011632	+4.0
	2. Boiled in 500 cc water 30 min.	375			1. .009655 2. .009936 Av. .009795	1. .001734 2. .001818 Av. .001776	1. .011389 2. .011754 Av. .011571	+4.3
	3. Boiled in 200 cc water 30 min.	375			1. .010288 2. .010527 Av. .010407	1. .001086 2. .001103 Av. .001094	1. .011374 2. .011630 Av. .011502	+3.7
	4. Steamed in steamer 30 min. using 500 cc water	450	*65.7	.013027	1. .012541 2. .012408 Av. .012474	1. .000293 2. .000279 Av. .000281	1. .012834 2. .012678 Av. .012756	−2.1
	5. Cooked in pressure cooker in 25 cc water at 10 lbs. pressure 12 min.	450	65.7	.013027	.012390	.000213	.012603	−3.3
String Beans	1. Boiled in 600 cc water 2 hrs. 30 min.	400	91.78	.003250	1. .002363 2. .002252 Av. .002307	1. .000933 2. .000904 Av. .000918	1. .003296 2. .003156 Av. .003226	−0.7
	2. Boiled in 600 cc water 1 hr.	400			1. .002690 2. .002427 Av. .002558	1. .000572 2. .000625 Av. .000598	1. .003262 2. .003052 Av. .003157	−2.9
	3. Boiled in 200 cc water 1 hr.	400			1. .002773 2. .002931 Av. .002852	1. .000351 2. .000344 Av. .000347	1. .003124 2. .003275 Av. .003199	−1.3
	4. Steamed using 600 cc water 1 hr.	400			1. .003059 2. .003018 Av. .003038	1. .000181 2. .000186 Av. .000183	1. .003231 2. .003202 Av. .003216	−1.0
	5. Pres. cooker no water added. cooked 10 min. 15 lbs. pressure	400			.003030	.000135	.003165	−2.6

Two different samples of turnip tops. English peas and butter beans were used.

Table III—Comparison of the Losses of Iron by Different Methods of Cooking*

Vegetable	Boiling in 400 cc to 1000 cc water 1 to 2½ Hrs.	Boiling in 400 cc to 1000 cc water ½ to 1¼ Hrs.	Boiling in 200 cc to 400 cc water ½ to 1¼ Hrs.	Steaming	Pressure Cooker
	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
Turnip Tops	18.0	16.1	7.3	7.7	4.9
Mustard	9.3	8.8	7.0	6.7	1.2
Collards	29.2	26.2	17.0	10.5	...
Field Peas	25.5	21.6	10.9	7.4	...
English Peas	13.1	10.8	8.0	5.0	7.3
Butter Beans	19.2	11.7	6.2	4.2	4.9
String Beans	29.0	24.3	12.2	6.7	6.8
Average	20.5	16.6	9.8	6.9	5.0

*The percentage of loss was calculated from the difference between the iron content of the total quantity of fresh vegetable cooked, and that of the cooked vegetable.

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